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NAME OF AUTHOR/*NOM DE L'AUTEUR* Warren E. Hathaway

TITLE OF THESIS/*TITRE DE LA THÈSE* A Feasibility Study of The Network Based Approach to Curriculum Development

UNIVERSITY/*UNIVERSITÉ* University of Alberta

DEGREE FOR WHICH THESIS WAS PRESENTED/*GRADE POUR LEQUEL CETTE THÈSE FUT PRÉSENTÉE* Doctor of Philosophy

YEAR THIS DEGREE CONFERRED/*ANNÉE D'OBTENTION DE CE GRADE* Fall 1975

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THE UNIVERSITY OF ALBERTA

A FEASIBILITY STUDY OF THE NETWORK-BASED APPROACH TO CURRICULUM DEVELOPMENT

by

WARREN ELKANAH HATHAWAY

(C)

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF EDUCATIONAL ADMINISTRATION

EDMONTON, ALBERTA

FALL, 1975

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "A Feasibility Study of the Network-Based Approach to Curriculum Development" submitted by Warren Elkanah Hathaway in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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ABSTRACT

The network-based approach to curriculum development and implementation, based on Program Evaluation and Review Technique (PERT) principles, was designed in 1970 as a method to improve classroom instruction. Like many innovations, this approach aroused interest. Teachers soon began to use it to develop curricula for individualized instruction. In five years time, thirty-four teachers had become involved in fourteen network-based curriculum development projects. Others were indirectly involved.

This study was undertaken to determine if the network-based approach to curriculum development and implementation can be used by classroom teachers to improve their classroom instruction. The research questions asked:

1. Is the network-based approach to curriculum development and implementation more effective and efficient than other alternatives known and used by teachers in managing instruction in their classrooms?

2. Is the network-based approach to curriculum development and implementation feasible for use in classrooms?

3. Is the perception of feasibility a function of: experience with the network-based approach; the hierarchical rank held by the respondent; or, other variables?

4. Is the procedure offered for use by teachers engaged in developing and implementing network-based curricula useful in its present form?

Development of a conceptual framework for studying educational feasibility was the first step taken in this study. Educational feasibility was found to be constrained by: quality (effectiveness and efficiency), organizational factors, technology, politics, pedagogy, timeliness, and generalizability. Out of the conceptual framework, a research design was developed for studying the feasibility of the network-based approach to curriculum development and implementation. Next, facets of the research design were incorporated into a questionnaire which asked participants in network-based projects to compare this approach with other alternatives known to them.

The findings of the study show that the respondents hold the network-based approach to be more effective, more efficient, and more feasible for classroom use than other alternatives known to them. Though perceived to be technical, teachers felt that they had derived benefits from use of the approach. Moreover, students in network-based programs were perceived as working harder and being more satisfied with their progress. In some instances discipline problems appeared to decline. Though a number of significant differences in perceptions of feasibility were found in the study group, there was no evidence to suggest that the significant differences were capable of rendering the other findings of the study invalid. The procedure offered for use by teachers developing network-based curricula was found to be inadequate--it was both inflexible in application and lacking in information.

Feasibility studies are intended to determine the probability of an innovation being adopted successfully. As

perceived by the study population, the network-based approach to curriculum development and implementation can be used by classroom teachers to improve their classroom instruction. On the basis of these findings it may be concluded that further adoption of the network-based approach should have a relatively high probability of success. The findings of the study also tend to justify the recommendation that other systems analysis techniques should be analyzed for potential contributions to an educational technology.

ACKNOWLEDGEMENTS

Appreciation is extended to the many people who contributed to the successful completion of this study. This study would have been impossible without those teachers who first adopted the network-based approach to curriculum development and implementation and then so kindly agreed to participate by completing questionnaires. Valued guidance, criticisms, words of encouragement, and supervision were offered by Dr. J. J. Bergen (the supervisory committee chairman), Dr. C. S. Bumbarger, and Dr. D. M. Richards. As well as participating as a member of the supervisory committee, Dr. N. L. Hersom made many valued contributions to development of the network-based approach to curriculum development and implementation. Thanks are extended to Dr. J. O. Fritz for serving as the external examiner. Also deserving of thanks are Mrs. C. Prokop who assisted with the analysis of the data; Dr. T. A. Blowers and the Edmonton Public School Board for allowing me to collect data in selected schools, and Miss Heather Paulsen who typed the manuscript. Finally, thanks are extended to my wife, Lois, and sons, Ralph and David, without whose support and sacrifice this study would never have been completed.

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Chapter 1

BACKGROUND AND DEFINITION OF THE STUDY

BACKGROUND TO THE STUDY

Rationale

As the technological revolution sweeps our society along, it leaves in its wake both benefits and problems. North Americans enjoy a standard of living unrivaled in many other parts of the world. Extensive resources and efficient production techniques have been combined to produce an amazingly diversified array of products. Technology enables man to circle the earth, often in less time than it takes to drive across town. Synthetic parts are used to rejuvenate our tired, worn, or diseased bodies. Change brought about by the technological revolution affects most aspects of society and the rate of change is gathering momentum.

> If this concept of change were plotted on a graph, the lower coordinate would represent time--the lower left corner being the beginning of man's history about 10,000 years ago and the lower right corner being the present. The vertical coordinate would be change, represented by a number of factors--the speed with which man moves over the face of the earth, the amount of energy, actual change in the nature of work or the population of the world.
>
> We could see the dimension of change in relation to time and in relation to the last twenty years. The curve would run almost flat along the whole distance of the horizontal axis for about a mile, to a point around 1900. It would then swerve upward at an exponential rate for nearly the entire vertical distance to the present, but that seventy years would be represented by 2.5 inches of the line compared to the previous mile (Venn, 1971:75).

If examined separately, the rate of educational change

does not appear to have been either as rapid or as extensive as some of the other social changes. Perhaps, many people have been too involved in changing themselves to recognize the pressure that change has imposed on the educational system. Some people have been more perceptive. In the opinion of Harold Shane (1973:326-327) the impact of the exponential rate of change on education has resulted in a "crisis of transition":

> The unprecedented development that has most severely shaken society and the school is the crisis of transition. Scientifically and psychologically, most men and women in 1910 were closer to ancient Rome of 73 B.C. than they were to America of 1973 A.D..... By the early 1920s portentous changes were underway, and in the 50 years that have intervened, more changes have taken place than occurred in the previous 50,000 years.

Herold (1970:23) is of the opinion that change, or expansion, alters the lives of successive generations:

> The expansion is not measured in terms of clock time, but in terms of experience, or what we might call subjective time. For a living being, time seldom passes according to the clock but it is judged in terms of experience. This is an interesting paradox here, in that time spent in interesting pursuits passes rapidly, whereas time spent in illness drags. Yet in recollection, we exactly reverse this and we remember time largely in terms of interesting experiences. But it is recollection that counts, since that is when stored information is used. Thus, the paradox is resolved in that we may conclude that more experience and more information are subjectively equivalent to a longer life.
>
> To carry the thought further, consider a man who lived 70 clock years from, say, 1850 to 1920, and add up his potential experience as a measure of 70 experience years. His grandchildren, living from 1910 to 1980, could if they fully absorb their potential of information (experience), easily exceed 400 experience years. Their children, 1930-2000 A.D., may exceed 700 experience years.

How many educators are there today who act as though

today's children at school entry age may be, experientially speaking, older than their counterparts at the turn of the century by a factor of ten? How many schools are there that can boast a curriculum capable of keeping pace with the exponential rate of social change and the resulting increases in new knowledge? Many of the reports tend to be pessimistic. Grant Venn (1970:94) asked:

> What about the fact that the curriculum, methods of teaching, individual assistance and tutoring, and special courses are about the same as they were thirty years ago, regardless of the student's background, needs for special help, motivation, parental interests, home environment, or level of learning when school starts?
>
> What about the lag between what we know should be done in the schools and what is actually being done?

Kenneth Boulding (1970:13) wasn't any kinder in his assessment:

> The technology of teaching is still not very different from what it was in the days of Plato. This is particularly true in the universities; in the grade schools unquestionably there is greater variety and much more use is made of educational tools such as movies, film strips, and other visual aids and there is even a small move into computer-assisted instruction. It is very doubtful, though, whether much more knowledge-value is being produced per hour of teacher time or per real dollar of total expense than it was a hundred years ago, or even twenty-five hundred years ago.

Even Goodlad and Klein (1970:72), describing what they found "behind the classroom door", declared that:

> A very subjective but nonetheless general impression of those who gathered and those who studied the data was that some of the highly recommended and publicized innovations of the past decade or so were dimly conceived and, at best, partially implemented in the schools claiming them. The novel features seemed to be blunted in the effort to twist the innovations into familiar conceptual frames or established patterns of schooling. For example, team teaching more often that not was some pattern of departmentalization and nongrading looked to be a form of homogeneous grouping. Similarly, the new content of the curriculum projects tended to be conveyed with the baggage of traditional methodology.

Might some student protests of irrelevancy be triggered by these shortcomings in the educational system? Shane (1973:328) has taken that position:

> ...Whether we like it or not schools--like mirrors--nearly always reflect rather than create or reform culture. (Sometimes the "social mirror" is so distorted that we can't even get a clear reflected image!)
>
> As T. R. Bassett points out (see p. 16, September 1972, Kappan), the schools didn't demand relevance, it was the students who first did so. For the most part, it was pressure from the blacks that led to black studies, not pressure from educational leadership. Virtually no pioneering curriculum ventures emphasized environment education prior to 1968; the problems of pollution first appeared in public forums, then found their way into the classrooms. The same is true of womens' rights....

Much of the impact of change on the educational system can be isolated to two areas. First, the knowledge explosion coupled with demands for increasingly skilled labor in the market place means students must acquire relatively more skills and knowledge now than in the past (Lonsdale, 1971:46). This added burden on the educational system has been countered by a more 55.8 percent rise in the average number of school days attended per year in the period 1910 to 1960 (Denison, 1971:240). Secondly, educational costs are rising rapidly. Some observers of the American scene note a doubling of costs every decade (Johns, 1968:199; Lonsdale, 1971:48). Recently costs of education in Canada have been rising at a rate which exceeds the rate of growth of the Gross National Product (Wisenthal, 1970:1; Economic Council of Canada, 1970: 55-73 Hanson, 1971:20). Of these two problems, a solution to the first may lie with increased effectiveness within the educational system, a solution to the last with increased efficiency.

Why hasn't there been notable improvements in educational productivity and efficiency? One reason might be that innovations capable of increasing educational productivity and efficiency aren't being extensively utilized (Goodlad & Klein, 1970:72). Shane (1973:329-330) arrived at the same conclusion.

> A year or two ago, for instance, Herbert Von Haden and Jean Marie King inventoried and assessed around two dozen current ideas for improving teaching. Among the innovations were: individualization, multimedia centres, computer assisted instruction, simulation, behavioral objectives, team teaching, nongrading, programmed learning, vouchers, Montessori methods, microteaching, extended school year, and so on.... Probably no more than 25% of our schools have tried out a substantial number of these ideas--and then only on a limited basis.

Overshadowing failure to adopt innovations Shane (1973:327) identified another problem which he believes is confronting education--technology and its right usage:

> ...We have about a dozen years in which to adopt policies that will keep our naive use of technology from becoming a disease that could leave our planet with its beauty gone and only its helplessness remaining.

Much more optimistic in this regard was Toffler (1970:275) who argued that just as automation technology caters to our most outrageous material wants and desires so can it be used by educators to provide educational programs at once both compatible with complex social contexts and capable of meeting the needs of individuals. It is the use of advanced technology that will enable this quantum leap--primitive technology only insures standardization (Toffler, 1970:266-267).

In government, business and industry technology is defined as that set of applied sciences which were devel-

oped for use in operations ranging from obtaining raw materials to developing and delivering the finished products. Such usage of the term is in agreement with Galbraith's (1967:24) definition:

> Technology means the systematic application of scientific or other organized knowledge to practical tasks. Its most important consequence...is in forcing the division and subdivision of any task into its component parts. Thus, and only thus, can organized knowledge be brought to bear on performance.

Daniel Bell (Knezevich, 1973:34) has regarded technology as a source of change:

> Technology multiplies the number of possibilities 'for mastering nature, and transforming resources, time and space' and thereby is a prime stimulator of future change.

The broad concept of technology can be partitioned into a number of specific technologies. Educational technology is one. Coombs (1968:111) offered a definition of educational technology:

> Educational technology, broadly conceived, includes all of the different methods, materials, equipment and logistic arrangements employed by education to further its work. These range from the lecture method to Socratic dialogue, from the seminar to the drill session. They include the blackboard, desk, and textbook; the pupil-teacher ratio and the layout of classrooms and corridors; the chronological grade system, the academic calendar and the school bell that punctuates time into modular units; the examinations and grades that influence students' futures. Each of these is an integral part of a 'system' and a 'process' whose ultimate objective is to induce learning.

Davies (1972:1-2) offered another definition of educational technology. Educational Technology is:

> ...A well disciplined and systematic approach to education and training characterized by explicitness, by sophisticated analysis and synthesis, by the utilization of optimal decision-making procedures and by rigorous empirical evaluation.

Because of incomplete agreement about the domain of educational technology and in order to simplify subsequent discussions, educational technology is defined in this study as an applied science of education which includes methodologies for planning, implementing, and evaluating instructional programs.

Planning, programming, budgeting systems (PPBS) were offered as one alternative for resolving some of the educational problems already noted. Judging from the glowing terms President Lyndon Johnson used in introducing program budgeting into the departments of the Federal Government (Novick, 1967:xv) one might have expected that when applied to education, most of the ills would have quickly vanished.

Unfortunately, evidence is accumulating that PPBS, as presently applied in education, is not the panacea anticipated. Some educators (Kiser & Edwards, 1972; Knezevich, 1973:249) have found PPBS models difficult to implement. Moreover, many educators have been hoaxed into believing that PPBS is more than it is: believing that a management tool will make decisions, believing that quantified cost figures are the ultimate comparison to be used in evaluating objectives, believing that people readily adapt to the systems approach, and believing that objectives are easy to quantify (James, 1973:28-33)

Gott's (1970) study indicated that many administrators felt they lacked the skills to implement PPBS, skills in the use of various systems analysis techniques which were in common use in government, business and industry when PPBS

emerged on the scene. Though PPBS implementation in government, business and industry was contingent upon use of many of these techniques and practices, educators have attempted to adopt some form of PPBS without first working out the necessary supporting educational technology. Several pioneers in educational applications of PPBS (Hartley, 1968:91; Alkin, 1970; Curtis, 1971:201; Haggart, 1972:153; Knezevich, 1973:174-178) have agreed that effective implementation of PPBS is more likely to be achieved through use of an educational technology which draws upon a wide variety of systems analysis techniques.

Curtis (1971:193), commenting on the lack of adequate skills perceived by administrators and reported by Gott (1970), noted that:

> When a comparison is drawn between these inadequacies and the lack of publications which document clearly the practical applications of the total concept, it becomes increasingly clear that much 'hard-nosed' research and development lies ahead.

Unfortunately, this development and research will probably occur slowly for as Curtis (1971:201) further noted:

> To find many persons who are well trained in the areas outlined above...PERT (Program Evaluation and Review Technique), CPM (Critical Path Method), the development of MIS (Management Information Systems) and EDP (Electronic Data Processing)...is an impossible task at this time.

Though recent literature gives evidence that the situation is no longer impossible, filling the documentation void located by Curtis (1971:193) is a long process which involves design, development, and evaluation of the required procedures. This must be followed by promulgation of the procedures to the users in a way that is both understandable and acceptable.

The Network-Based Approach to Curriculum Development

Development of the network-based approach to curriculum development and implementation (Hathaway, 1970) was but a single contribution to an educational technology. Based on PERT (Program Evaluation and Review Technique) concepts, its intended purpose was to improve the quality and quantity of production in a classroom unit. Results of the original study suggested that the network-based approach to curriculum development might be a feasible method for: selection and organization of curriculum content; intersubject integration of the curriculum content; and, management of information and student records in such a way as to to make individualization of instruction in classrooms both practical and realizable. Individualization of instruction occurred on the basis of variations in: curricular content; rates of student progress; and, instructional strategies. Work carried out by other classroom teachers attests to the applicability of the network-based approach to development of curricula and individualization of instruction (Department of Industrial and Vocational Education, 1971; Ziel, 1971; Young, 1972; 1973; Beaumont, 1973:5; L. Hathaway, 1973:91; Irvine & Kupchenko, 1973:95; Irvine & McElroy, 1974:125; McElroy, 1973:97; McElroy & Hathaway, 1974: 127; Preitz, 1974:27).

Context of the Study

A number of factors arising out of the previous discussion can now be brought into focus. Social change is imposing a variety of influences on education. Students enter-

ing schools today are different than they were a decade or two ago. The amount of information that must be assimilated by a student before he leaves school has increased. Various innovations have been introduced in an attempt to increase educational effectiveness and efficiency. Among them is the network-based approach to curriculum development and implementation. Whether or not the network-based approach to curriculum development and implementation may be regarded as a feasible tool for use in meeting some of the demands confronting education at the classroom level is the problem addressed by this study.

DEFINITION OF THE STUDY

Statement of the Problem

Can the network-based approach to curriculum development and implementation be used by classroom teachers to improve their classroom instruction? Two major questions are imbedded in the problem statement.

1. Is the network-based approach to curriculum development and implementation an effective and efficient means of managing classroom instruction?

2. Is the network-based approach feasible for use in classrooms?

Feasibility is constrained by a number of variables: economic, organizational, technical, political, pedagogical, timeliness, and generalizability.

Definition of Terms Used in the Study

Classroom instruction. Classroom instruction embodies all of the activities a teacher undertakes in planning and implementing instruction in a classroom.

Educational technology. Educational technology is the applied science of education and includes methodologies for planning, implementing, and evaluating instructional programs.

Effectiveness. Effectiveness describes the degree to which stated program objectives are achieved.

Efficiency. Efficiency describes the degree to which resources are consumed in the achievement of a program objective.

Feasibility. Feasibility is defined as the "...capability of being carried out or completed successfully, with predicted success significantly greater than chance" (Kaufman, 1972:127).

Individualized instruction. Individualized instruction describes a form of instruction wherein programs for individual students have flexibility in terms of curriculum content, rates of progress, and instructional strategies.

Network-based approach to curriculum development. The network-based approach to curriculum development is a PERT-based methodology for developing curriculum, implementing it in a variety of ways (including individualized instruction), and evaluating both the curriculum and the progress of students on the basis of empirical data pertaining to student performance.

In using the network-based approach the curriculum

is structured into a network by adhering to basic PERT principles. The completed network serves three major purposes: it provides a picture of the total curriculum; it is divisible into subnets which may be used as a record-keeping system for individualized instruction; and it serves as a means of codifying, storing, and retrieving all instructional materials. By further adhering to PERT principles, empirical data can be collected for use in evaluating both students' progress and the curriculum.

PERT (Program Evaluation and Review Technique). PERT is a management technique used for translating programs into flow diagrams reflecting planned events, objectives, or activities and their interdependencies and interrelationships.

Procedure. A procedure is a series of logical steps by which routine actions are initiated, carried forward, controlled, and finalized.

Productivity. Productivity is a term used to describe the quantity and quality of educational outcomes.

Assumptions

A number of assumptions underly this study.

1. Educational practices at the classroom level can be improved.

2. Perceived feasibility of an innovation will be affected by the specific policies and established practices which prevail in each test situation.

3. Teachers will employ educational practices perceived to have a high relative advantage and will reject others.

4. The expressed judgements and perceptions of individuals can be collated and aggregated into indices and measures.

Research Questions

Four research questions have been set forth as stepping stones in answering the study problem.

1. Is the network-based approach to curriculum development and implementation more effective and efficient than other alternatives known and used by teachers in managing instruction in their classrooms?

2. Is the network-based approach to curriculum development and implementation feasible for use in classrooms?

3. Is the perception of feasibility a function of: experience with the network-based approach; the hierarchical rank held by the respondent; or, other variables?

4. Is the procedure offered for use by teachers engaged in developing and implementing network-based curricula useful in its present form (Hathaway, 1970; 1971)?

Significance of the Study

The essence of the opinion cited thus far suggests that because increases in educational costs are outstripping increases in educational productivity better educational practices ought to be developed and utilized. There are those who argue for use of business and industrial practices in solving educational problems and in so doing argue for an educational technology--an applied science of education that offers a systematic way of doing things. Some argue that

the former is the key to the latter.

The network-based approach to curriculum development and implementation (an approach that relies on PERT technology) was designed to improve curriculum development, implementation and evaluation practices, at the classroom level, and in ways compatible with PPBS.

Whatever the results of this study prove to be, this study ought to make a contribution to educational thought. If the network-based approach is shown to be a feasible means of improving the effectiveness and efficiency of classroom instruction then at least three avenues will be opened.

1. Recommendations may be made for more extensive utilization of the network-based approach.

2. Classroom teachers should have tools enabling them to make meaningful contributions to implementation of PPBS models.

3. Other business and industrial practices may be examined for their potential contributions to an educational technology.

If the study shows that the network-based approach is unfeasible (and the shortcomings of the approach cannot be overcome) then many of the arguments favoring use of business and industrial practices in education should be thrown open to question.

Method of Inquiry

Several steps were taken in deriving an answer to the study problem.

1. A review of literature provided the basis for identification of: factors serving to constrain feasibility, methods of studying feasibility, and, sources of data upon which determination of feasibility may be based.

2. The identified facets of the feasibility study were organized into a conceptual framework.

3. Using the feasibility study conceptual framework as a guide, a research design was developed for this study.

4. The criteria for assessing the constraints to feasibility were derived from a literature review.

5. The study method and sources of feasibility determination data were identified.

6. Having completed Steps 4 and 5 (above), the feasibility assessment criteria were translated into a study questionnaire.

7. A data collection and analysis plan was developed and implemented.

8. The findings from the analyzed data were reported, discussed, and then summarized into a set of conclusions, implications, and recommendations for further study.

Delimitation

Several factors served to delimit this study.

1. The study examined the network-based approach as it was applied in a number of isolated projects at the

elementary, secondary, special, and post-secondary levels of education in the Edmonton area.

2. Data sources were limited to teachers and instructors who were directly involved in these projects and those other teachers, specialists, counsellors, and administrators who had an opportunity to observe these projects and the students involved in them.

3. Students were eliminated from the study group because adequate historical records were not available. Teachers were asked to render judgements about the effects of the network-based approach on students. To some extent, this decision is defensible on the basis of a number of studies (Henig, 1949; Ilg & James, 1965; Hall, 1966; Kirk, 1966; Irvine, 1968:68) which suggest that teachers are nearly as effective in some student assessments as some of the well-known standardized tests.

4. The literature review was limited, for the most part, to the post-1968 period because formal educational feasibility studies are relatively recent practices. At the same time the literature review was concluded late in 1974 so that the survey instrument could be designed.

5. The study was limited to an examination of feasibility in terms of qualitative, organizational, technical, political, pedagogical, timeliness, and generalizability constraints. Because of a lack of knowledge about how it might be assessed at the classroom level, economic feasibility was not assessed in this study.

6. The criteria for assessing educational feasibility were also determined on the basis of a literature review. Because of the volume of potential material the review was not exhaustive but rather it was limited to a determination of common factors and identification of areas of general consensus.

7. Feasibility was determined in part on a theoretical plane and in part on an operational plane. On the operational plane the study focused on what might be considered feasible in practice and treated current network-based projects as pilot studies. At the theoretical level the study focused on the potential of the network-based approach.

Limitations

Several factors constrained or limited this study.

1. The study was limited to a relatively small study population. This was due to the fact that the network-based approach was first demonstrated in a classroom in 1970 and has not had time to diffuse to a large number of other classrooms.

2. Being the first study into the practicality of the network-based approach, many unknowns were encountered. Owing to the high degree of uncertainty prevalent, absolute measures were avoided in favor of tests which determine what has been accomplished. Accomplishments were assessed on the basis of opinion. Thompson (1967:86) refers to these tests as "instrumental tests".

3. The study was limited to some extent by designer bias.

4. The study was further limited to some extent by respondent bias. Part of this bias could result from the fact that some of the respondents had a personal interest in the network-based approach. They had adopted the approach. Another part of the bias could be attributed to the "Hawthorne effect".

SUMMARY

This chapter has drawn together opinions suggesting need for improvements in educational practice. Some advocate development of an educational technology, based on practices developed for use in business and industry, as a way of improving educational practice. Reflecting this view is the network-based approach to curriculum development and implementation which is now being used in several projects at the elementary, secondary, special, and post-secondary levels of education in the Edmonton area. The problem outlined in this chapter necessitates determining if the network-based approach can be used by classroom teachers to improve their classroom instruction.

Overview of Other Chapters

Chapter 2 contains a review of the literature and a conceptual framework for use in determining the feasibility of educational projects. Chapter 3 presents the research design. Chapter 4 describes the methodology of the study. The findings from the analyzed data are discussed in Chapter 5. A summary of the study, conclusions, implications, and recommendations for further study are presented in Chapter 6.

Chapter 2

A REVIEW OF LITERATURE PERTAINING TO EDUCATIONAL FEASIBILITY STUDIES AND DEVELOPMENT OF A CONCEPTUAL FRAMEWORK FOR ASSESSING EDUCATIONAL FEASIBILITY

LITERATURE REVIEW

Scope of the Literature Review

The literature review served to determine what constitutes feasibility and how educational feasibility has been measured in a number of cases. The findings from this literature review were incorporated into a conceptual framework which served as a guide for the research design used in this study.

Factors of the Feasibility Study

In this study the feasibility of the network-based approach to curriculum development and implementation has been examined. The first question which had to be answered asked "What constitutes feasibility?" Only by knowing what constitutes feasibility could a research study be designed to determine the feasibility of any particular approach or phenomenon.

Feasibility, according to the lexicographers, means "capable of being carried out". It is useful at the outset to distinguish feasibility determination from evaluation which is defined by Curtis (1971:51) as "...the process of assessing

the attainment of objectives and the worth of programs". Feasibility then amounts to an assessment of an undertaking before implementation, and evaluation applies to assessments made during and after implementation.

Definitions of feasibility which are more specific than those offered by lexicographers are offered by relatively few educational theorists, mainly those who also advocate the use of systems analysis and other business and industrial management practices.

Kaufman (1972:127) has defined feasibility as the:

> ...Capability of being carried out or completed successfully, with predicted success significantly greater than chance.

Alone, Kaufman's definition fails to identify the critical dimensions which are likely to constrain feasibility. Others suggest some of these potential constraints.

Hussain (1973:196) shed additional light on the meaning of feasibility. To one involved in operations research a feasible solution is an optimum solution. To the computer scientists the feasibility study leads to a decision to acquire, or not to acquire, computer equipment. To the system analyst feasibility describes the practicality of a proposed change. It is in this sense that feasibility is used in this study.

Hussain (1973:204) enlarged the concept of feasibility by identifying and describing three types of constraints: economic and financial constraints, organizational constraints, and technological constraints.

Dror (1968:35) suggested that feasibility may be constrained politically.

Still other constraints to feasibility were identified from an examination of a number of educational feasibility studies.

Johnson and Shearon (1970) reported a study directed towards validation of the Georgia Educational Model for Elementary Teacher Preparation. Their study was prefaced by several definitions (Johnson & Shearon, 1970:6):

> Feasibility. The extent to which an occurrence or specific condition is possible or likely to take place.
>
> Theoretical feasibility. The possibility of the attainment of a specific condition or occurrence prior to its demonstration in reality.
>
> Technical feasibility. The extent to which technology (both system and mechanical) is available to accomplish a condition or occurrence which is regarded as theoretically feasible of being accomplished.

The Georgia study (Johnson & Shearon, 1970:17) considered feasibility criteria on two levels. The first-order feasibility criteria suggested that:

1. the program model should produce better teachers,
2. the developed strategy for developing and engineering the model should be effective in accomplishing its goals, and
3. the program model should be socio-psychologically feasible.

These first-order criteria were further subdivided into second-order criteria suggesting that:

1. the model should be reasonable in terms of demands

on the time of students, teachers, and administrators,

2. the costs should be in line with present costs,

3. the instructional program should be acceptable to man's environment,

4. the needed materials and equipment should be attainable, and

5. the model program should be transportable to other institutions.

Johnson and Shearon (1970:21) further suggested four methods for conducting a feasibility study: consultation with experts, assessment based on selected criteria, simulated demonstration, and operational demonstration.

A study conducted at the University of Massachusetts (1970) to examine the feasibility of a Model Elementary Teacher Education Program attempted to answer six questions.

1. Is the model pedagogically sound--does it work?

2. Is the model economically feasibile?

3. Is the model administratively feasibile?

4. Is the model technically feasible?

5. Are the clients (those served by the model) satisfied?

6. Will the model retain relevance for teacher education (University of Massachusetts, 1970:1)?

The study method adopted by the University of Massachusetts was comprehensive. Pedagogical feasibility was determined separately for each subject area by a study team. Each of the other constraints was assessed across the entire

program with many of the feasibility assessment criteria selected on the basis of common sense.

Michigan State University established feasibility criteria somewhat eclectically in their study into the feasibility of a behavioral Science Teacher Education Program (Michigan State University, 1969).

Several other studies (Fiasia, 1966; Agin, 1970; Green, 1970), though purporting to assess feasibility, conducted controlled experiments to show that their methods or approaches yielded better results than the control methods--they contained an element of evaluation.

Rudman's (1970) study at the University of Massachusetts examined the feasibility of the Language Arts component of the University of Massachusetts study already discussed.

Melnotte (1970:7-8) in his study into the operational feasibility of an apprenticeship work-study program raised a number of questions, some of which appear to be generalizable to a variety of feasibility studies.

1. How effective is the program in terms of the knowledge and skills gained?

2. How successful is the program?

3. How generalizable or exportable is the model or approach?

4. What is the student reaction to the program?

5. What should be the content and procedures for follow-up?

6. How responsive is the manpower pool?

7. What modifications of the model, or approach, might be considered for future efforts?

When a feasibility study should occur in the planning cycle is yet another question somewhat open to debate. Kaufman (1972:119) suggested that feasibility can be determined as part of an on-going study. Hussain (1973:195-217) outlined a discrete feasibility study plan. Most of the studies already cited were of this latter type.

The Concept of Feasibility

The reviewed literature suggests that feasibility is a multi-faceted concept. Hussain (1973:204) identified economic and financial constraints, organizational constraints, and technological constraints. Dror (1968:35) identified a political constraint. Johnson and Shearon (1970:17) suggested that feasibility is constrained by judgements of quality--effectiveness and efficiency. The concept of feasibility was further enlarged, by the studies carried out at the University of Massachusetts (1970), to include a pedagogical constraint and a constraint of timeliness. Their administrative constraint appeared similar to Hussain's organizational constraint. Generalizability was identified as a constraint in the studies carried out by both the University of Massachusetts (1970) and Melnotte (1970).

Two sources of data for assessing feasibility were identified through an examination of the literature. Johnson and Shearon (1970) discussed assessment of feasibility theoretically. Most of the other cited studies assessed feasibility

operationally--through pilot studies or demonstrations.

Finally two schools of thought were identified pertaining to feasibility study methodology. Kaufman (1972: 119) prefers to continuously assess feasibility while nearly all of the other studies determined feasibility by means of a specific study conducted prior to implementation of a plan or innovation. Johnson and Shearon (1970) identified four ways in which a specific feasibility study may be carried out: through consultation with experts, assessment, simulation, and demonstration.

DEVELOPMENT OF A CONCEPTUAL FRAMEWORK FOR STUDYING EDUCATIONAL FEASIBILITY

Facet Analysis and Design

Facet design (Runkel & McGrath, 1972:17-21) is a means of laying out a research domain. It identifies the limits of the domain and systematizes the ordering of subparts or elements. Maximum power of a facet design is achieved when the facets and their elements conform to a set of rules (Runkel & McGrath, 1972:19):

> 1. Objects should be classified by all the properties or facets that the investigator has chosen as relevant to his study. Any 'object'--be it concept, event, person, or whatever--has more than one property in common with others. A facet design will be more comprehensive and serviceable if a facet applicable to any object is applicable to all.
>
> 2. Each facet should be divided into an exhaustive set of categories or elements; that is, every object must be classifiable in one of the elements.
>
> 3. The elements of each facet should be mutually exclusive; that is each object must be classifiable in only one of the elements.

4. The logical relation among the elements of a facet should be specified. A facet design is more powerful if the elements can at least be ordered.

5. The logical relations among facets should be specified. Ideally, the act of classifying an object within one facet should put no constraint on its classification within another.

6. The facets, collectively, should exhaust the domain of interest.

A Conceptual Framework for Studying Educational Feasibility

Three facets emerged from the reviewed literature: constraints to educational feasibility, feasibility study methods, and sources of feasibility determination data. One way of examining the interrelatedness of these facets is through use of a cubic model. Subdividing each facet of the cube by the elements derived from the literature review yields a conceptual framework for studying educational feasibility (Figure 1).

One of the risks associated with development of a matrix or cubic model is that some of the cells may be meaningless. The conceptual framework in Figure 1 is no exception--the shaded cell representing a "theoretical demonstration" is an example. There may be others, although they are not so obvious.

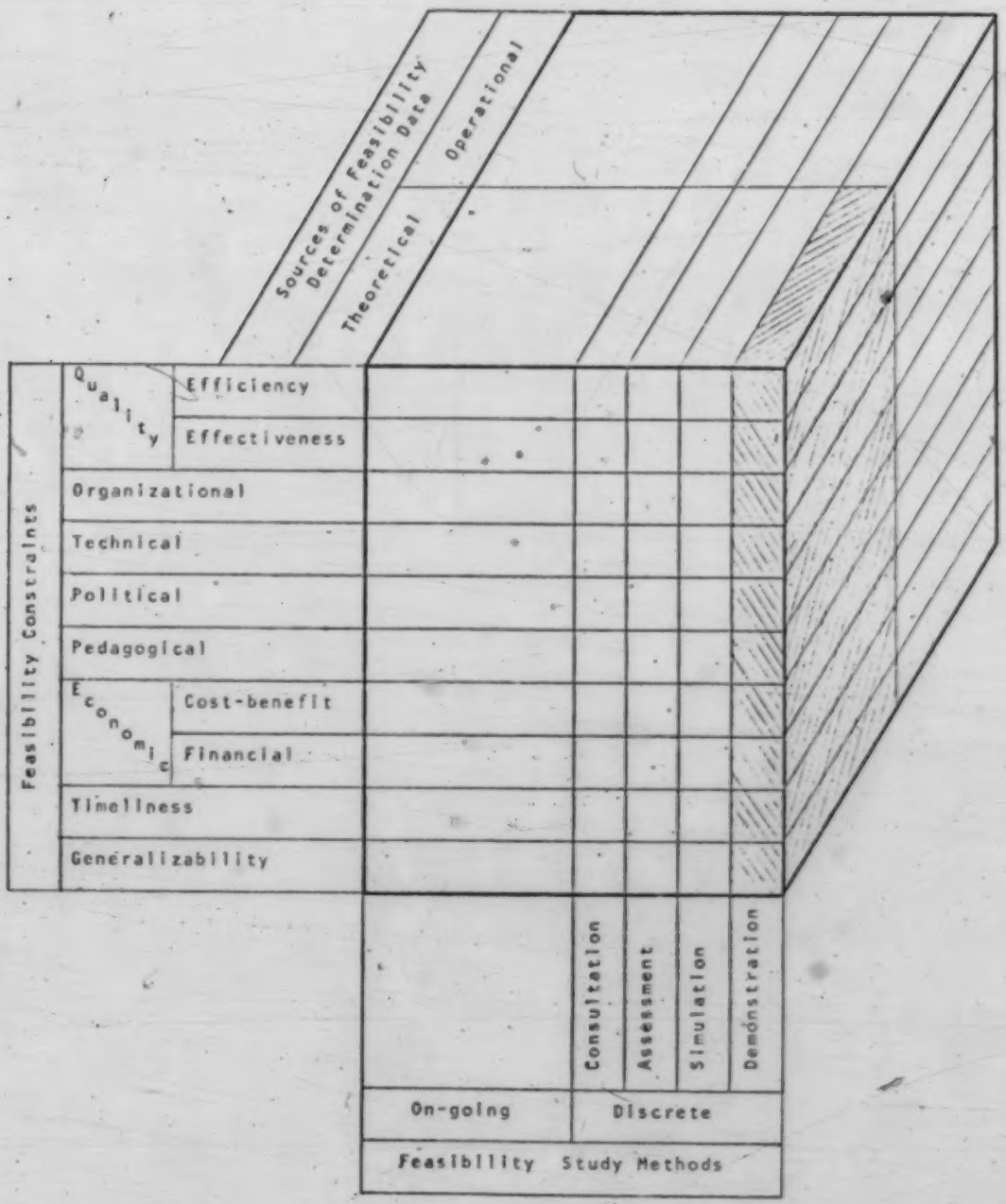
An initial assessment of the conceptual framework can be completed by examining it in terms of the criteria set forth by Runkel and McGrath.

1. Objects (criteria falling into specific cells) can be classified by all of the facets chosen as relevant.

2. Each facet is subdivided into a set of elements.

Figure 1

A Conceptual Framework for the Study of Educational Feasibility



Each set is exhaustive to the extent that all identified objects can be classified in one of the elements.

3. The elements appear to be mutually exclusive.
4. A relationship among elements is suggested.
5. A relationship among the facets is suggested.
6. The facets, collectively, exhaust the domain of interest and concern revealed by the literature review.

SUMMARY

A number of feasibility studies were reviewed in order to facilitate development of a conceptual framework for studying educational feasibility. In these studies three facets of feasibility studies were identified: constraints to educational feasibility, feasibility study methods, and sources of feasibility determination data. These three facets, together with their constituent elements, were organized into a conceptual framework. This conceptual framework served as the basis for the research design discussed in the next chapter.

Chapter 3

RESEARCH DESIGN AND DEVELOPMENT OF A STUDY QUESTIONNAIRE

RESEARCH DESIGN

The conceptual framework for an educational feasibility study (page 27) identifies three facets (areas of interest) of feasibility studies: bases of feasibility determination data, feasibility study methods, and constraints to feasibility. Two of the research questions (page 13) focus on the feasibility of the network-based approach: one focuses on the quality constraints of feasibility, the other on the remaining feasibility constraints.

Bases for Feasibility Determination Data

Two bases of feasibility determination data were identified in the literature: theoretical and operational.

Theoretical feasibility. Theoretical feasibility, as conceptualized by Johnson and Shearon (1970:6), attemps to probe the question of plausibility. Plausibility is established when an approach, which has not yet been demonstrated, cannot be discounted on the basis of any known or foreseen constraints. In other words an approach can be regarded as theoretically feasible when there are no constraints forecasting its failure prior to implementation.

Operational feasibility. Operationally determined feas-

ibility is reckoned on the basis of an examination of a demonstration of the occurrence or approach. Typically, operational feasibility determination involves a pilot study.

Bases for determining feasibility in this study. The network-based approach is known by a relatively small group of educators in the Edmonton area. These people are either using the approach themselves or are in a position where they can observe others using it.

For the most part feasibility determination was on the basis of operationally-derived data--on the basis of on-going projects which were regarded as pilot studies. An exception occurred in Part II of the study questionnaire (Appendix B) which could have been answered only from a theoretical perspective. Most of the concepts contained in that part of the questionnaire were not encountered in the operational projects.

Feasibility Study Methods

Two schools of thought about methodology were identified in the literature review. One school suggested that the feasibility study is an on-going study from the inception of the approach to its ultimate implementation. The second school argued that at some point after the approach is designed, and before it is implemented, feasibility must be determined through use of a formal study.

On-going feasibility study. Kaufman (1972:119) described the nature of the on-going feasibility study.

> A methods-means analysis may begin whenever the

> analyst chooses. The experienced educational planner will undoubtedly find greater utility in starting the methods-means analysis as soon as a mission objective and associated performance requirements have been identified and stated. This, continual identification of possible "hows" and the relative advantages and disadvantages of each, means that an on-going feasibility assessment is being conducted.... As the system analysis continues, and as the methods-means analysis portion coincides, there is a continuous checking and assurance that it is feasible to suppose that the mission can be accomplished.
>
> When the planner has completed the task analysis and the final methods-means analysis, there are two products:
>
> 1. A data base of feasible "whats" for problem solution.
>
> 2. A data base of possible "hows" and the advantages and disadvantages of each.

Discrete feasibility study. The discrete feasibility study is designed to occur as one step in the design and development sequence. In essence it is an evaluation of an approach on a number of carefully selected variables or constraints. As suggested by Johnson and Shearon (1970:21) there are at least four ways of conducting the discrete feasibility study: consultation, assessment, simulation, and demonstration.

Selected method for this study. The purpose of the feasibility study is to gather information in order to determine the risks involved with adoption of an innovation. To achieve this purpose, several methods (see Figure 1, page 27) may be used. With the exception of "demonstrations", any method may be based on either theoretical or operationally-derived data.

For this study the assessment mode of the discrete study method was selected as the most appropriate for several reasons:

1. Had an on-going study been undertaken, it would have been difficult to have known when the study was completed.

2. The feasibility assessment criteria were suitable for incorporation into a study questionnaire.

3. Completion of a questionnaire demanded the least amount of time from the study population. A case study or interview, for example, would have taken longer to complete and would have also resulted in more difficult data analysis.

In summary, the study method selected for this study was an assessment. This was augmented by recording instances of adoption of the network-based approach in order to assess generalizability.

Feasibility Constraints

The first two research questions (page 13) necessitated subdivision of the feasibility constraint facet of the conceptual model into two subsets: a qualitative subset comprised of effectiveness and efficiency and a feasibility subset comprised of the organizational, technical, political, pedagogical, timeliness, and generalizability constraints. Because of the study delimitations (page 16), economic feasibility was excluded from further consideration.

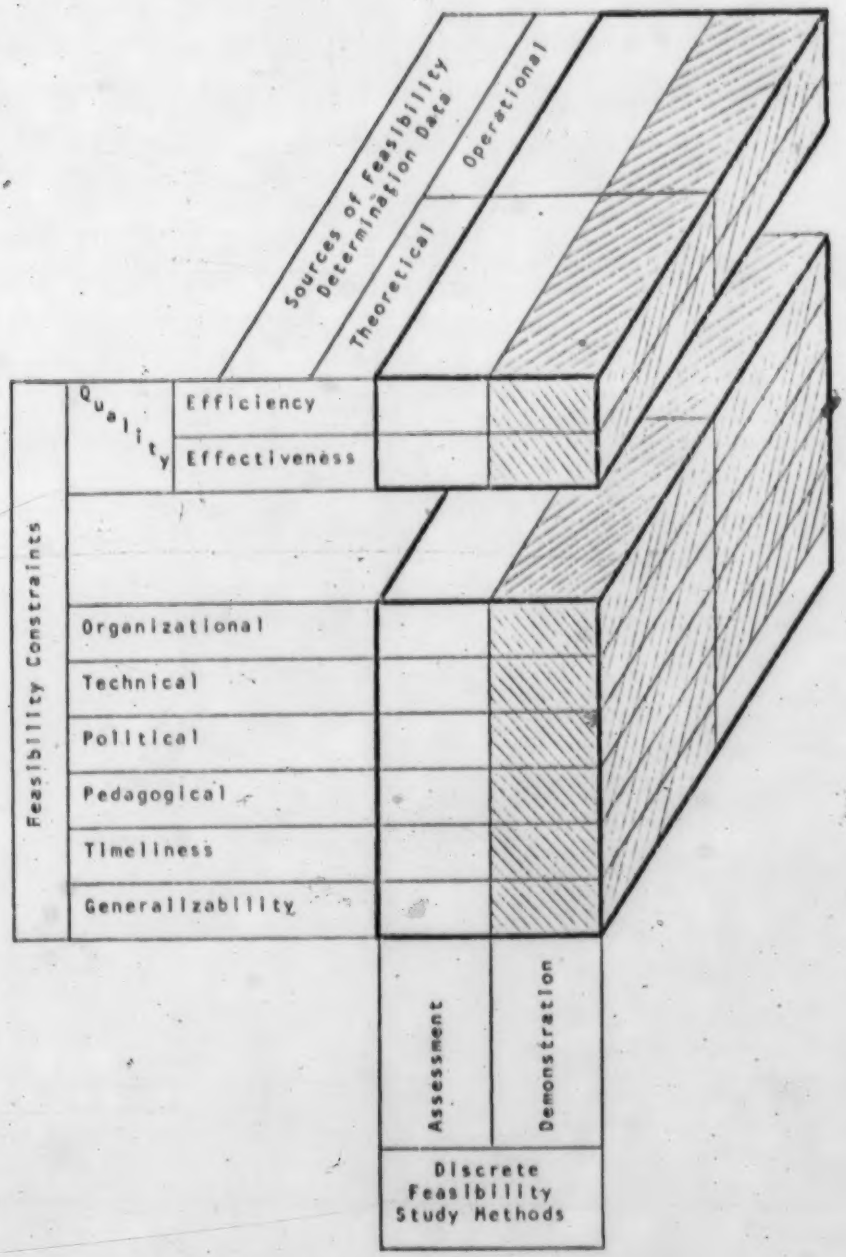
The Research Framework

The conceptual framework for an educational feasibility study was reduced, on the basis of the foregoing considerations, to the research framework reflected in Figure 2.

The study population was limited in size and consisted

Figure 2

A Research Framework for Studying the Educational Feasibility of the Network-Based Approach to Curriculum Development and Implementation



of 50 educators associated with network-based curriculum projects. For the most part the collected information was operationally derived--based on current projects which were regarded as pilot studies.

The assessment mode of the discrete study was chosen as the study method because of its relative ease of implementation. Demonstrations of the network-based approach were identified and tabulated in order to assess the generalizability of the approach.

DEVELOPMENT OF A STUDY QUESTIONNAIRE

A major step in this study was development of a questionnaire for use in assessing the educational feasibility of the network-based approach as specified in the research framework.

Seven feasibility constraints are identified in the research framework: qualitative, organizational, technical, political, pedagogical, timeliness, and generalizability. Because definitions of these constraints are not specific enough for assessment purposes, the following literature review served to identify some of the criteria by which feasibility might be assessed within each constraint as it applies to instruction in the classroom.

Other factors serving to constrain the design of the questionnaire included: uncertainty; the need to assess differences in perceptions (see research question 3, page 11); and, the need to evaluate the procedure for developing network-based curricula (see research question 4, page 13).

Qualitative Feasibility

The qualitative feasibility of a program or innovation may be assessed in terms of its effectiveness and efficiency. Effectiveness is determined by the degree to which stated objectives are achieved. Efficiency describes the degree to which resources are used to produce a unit of output.

Effectiveness. Effectiveness is a measure of goal attainment. "A goal is a broad statement of purpose to be achieved by a society, but to which the educational system will contribute by attaining related objectives" (Curtis, 1971:339). Goals describe ends or outcomes.

The literature is rich with descriptions of factors which either increase or decrease effectiveness or goal attainment.

Setting broad educational goals and searching for imbedded objectives and alternatives is enhanced by technology (Knezevich, 1973:56). Though many contend that a relatively unplanned or unstructured curriculum is most flexible in implementation, Knezevich would argue that planned or structured instruction may be expected to provide more instructional flexibility and more exciting points of departure than relatively unplanned instruction. Thus students needs and interests are more easily satisfied.

Goal setting and curriculum planning should consider the total curriculum rather than an agglomeration of fragmented subjects (Bebell, 1968:23; Fuller, 1968:76; Dunkel, 1972:82). Not only may integration increase the likelihood

that appropriate goals will be pursued, it may also reduce the likelihood that redundancies and overlapping goals will lower the organizational effectiveness. Moreover, integration serves to identify purposes for goals and objectives.

An innovation may contribute to effectiveness by:

1. Facilitating development of clear statements of goals and objectives.

2. Facilitating identification of objectives imbedded in other objectives.

3. Revealing purposes for objectives.

4. Facilitating the identification of alternative problem solutions.

5. Integrating objectives.

6. Minimizing the likelihood of gaps and overlapping objectives in the curriculum.

These factors were assessed by Items 11-15 of Part IV of the study questionnaire (Appendix B).

Efficiency. Efficiency at the classroom level is affected by the ways and means employed in realizing the educational goals.

Ways and means describe the educational processes whereby goals are realized (Kaufman, 1972:18).

Discussions of educational ways and means focuses on educational technology--the applied science of education. Knezevich (1971:57) suggests that technology will enhance teacher skills. This can occur in a number of ways:

1. Technology should improve the transmission of information.

> The idea of a teacher who conveys information and answers is now dying. Technology is beginning to perform this data function quite admirably. Teachers are beginning to realize that their main job begins after the learner has processed the information. That is when insights are verified, generalizations are tested, perceptions are expanded, and knowledge becomes wisdom (Worth, 1972:197).

2. Administrative practices and routines should be improved so that they consume a smaller portion of the teacher's total time. Among these are the practices of: information storage and retrieval, record-keeping, and student progress reporting.

3. Communications among interest groups might be improved and should lead to a greater degree of agreement concerning educational goals and the ways and means of achieving them. Included in these interest groups would be teachers, students, parents, and administrators.

4. There is a clear need to improve educational processes (Worth, 1972:211).

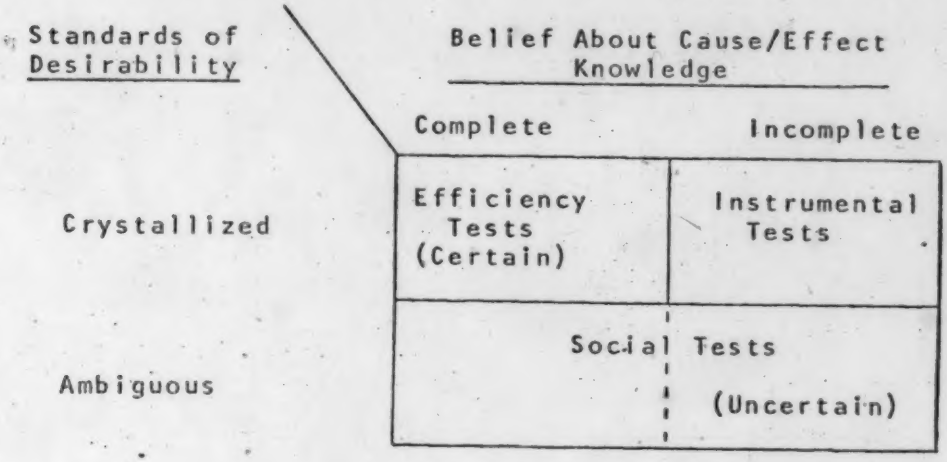
5. Evaluation processes used to evaluate students and the curriculum should be improved. Several areas can be identified which would contribute to this improvement.

Clearly defined goals lead to easier evaluation because less difficulty is experienced in gaining agreement about evaluation criteria. Evaluation ought to be based, in part at least, on the output of the educational system--the quality and quantity of students. Evaluation may also be expected to improve as the degree of uncertainty surrounding an event or activity is reduced. Certainty, or uncertainty, is regarded by Thompson (1967:86) as being com-

posed of two dimensions: standards of desirability and beliefs about cause/effect knowledge. Standards of desirability may range from crystallized to ambiguous while cause/effect knowledge may be complete or incomplete. Affixing these two dimensions to the axes of a matrix yields the model shown in Figure 3.

Figure 3

A Model Reflecting Factors of Uncertainty



The model in Figure 3 serves to indicate the appropriateness of various classes of tests and evaluative instruments. Absolute efficiency tests can only be applied when standards are crystallized and cause/effect knowledge is complete. Where both are vague various social tests must be used. When only the standards are crystallized the tests must be instrumental--they can only seek to determine if a desired state has been reached. Innovations should aid in reducing uncertainty.

6. Adoption of educational innovations should not necessitate that excessive amounts of time be devoted to pre-service and in-service training (Johnson & Shearon, 1970:17).

The efficiency of an innovation is enhanced by enhanc-

ing teachers' skills. This can be brought about by:

1. Improving the transmission of information to students, colleagues, and parents.

2. Improving classroom administrative practices (better utilization of available equipment and personnel, more useful and easily maintained student records). At the same time an innovation should be understandable without extensive in-service training.

3. Improving educational processes (increased student productivity, better use of time spent in planning and preparing instruction).

4. Improving evaluation processes of educational processes and products (the curriculum and the students).

These factors were assessed by Items 1d, 2a, 2b, 3a, 3b, and 4 of Part II and Items 1, 2, 3, 5, 6, 9, 10, 16, and 17 of Part IV of the study questionnaire (Appendix B).

Organizational Feasibility

Organizational feasibility is determined in terms of the impact the change has on the organization. Hussain (1973: 206) identified three areas of potential impact: the need for reorganization in order to implement the change; resistance to the change; and, human resources which are inadequate by virtue of quality and/or quantity.

Need for reorganization. It may be difficult to think of an innovation or change that does not have some impact on an organization, or change it in some way. To the extent that reorganization might be unavoidable there are a number of

factors to consider in developing an acceptable change.

A potential change should:

1. Separate the rightful roles of teachers and machines. This is especially critical in education for as Worth (1972:200) pointed out:

> The computer is a tireless, relentless, evaluating teacher that has several avenues of instruction at its disposal: sound, sight and touch. Its efficiency characteristics will put any teacher to shame who is foolish enough to compete. But it also has the potential to free a teacher from a host of routine directing and record-keeping duties, which add little to either the learning process or the humanizing process.
>
> This means the human teacher will be able to concentrate on truly human things. Anyone who has ever tried to be truly human to 25 people for five hours at a stretch will know how utterly exhausting that task can be.

2. Facilitate the phasing in of programs at the classroom level concurrently with other programs which are either in operation or being phased out. Students involved in transitional programs should experience few discontinuities.

3. Be equally effective in all programs.

4. Facilitate development of programs which can be implemented with equal success in any set of facilities.

5. Be usable by any typical staff without the need for extensively upgrading either.

Resistance to change. Resistance to change is a common occurrence in educational spheres and outside. The acceptability of a particular change is enhanced by the extent to which a number factors are adhered to.

1. Havelock (1973:13) and Kiser and Edwards (1973: 241) are of the opinion that users of an innovation should be

involved in determining the problems to be solved and in developing the solutions and alternatives.

2. Chin (1969:39-57) pointed out that a successful innovation ought to serve the self-interests of the participants.

3. Chin (1969:39-57), Havelock (1973:13-15), and Kiser and Edwards (1973:241) recommended that changes should specify the "who", "what", "why",and "when" of a plan but that "how" should be left largely to the participants.

4. Rogers (1962:124-133) identified five characteristics of an innovation which affect its adoption.

a. Relative advantage--the extent to which it is perceived as being superior to other alternatives.

b. Compatibility--the extent to which the approach is compatible with the experiences and values of the prospective adopter.

c. Complexity--the extent to which an innovation is complex and difficult to understand.

d. Divisibility--the extent to which an innovation can be subdivded and adopted on an installment basis.

e. Communicability--the extent to which an innovation can be easily communicated to others.

Human resources. Many educational changes involving the use of systems analysis and business and industrial practices run the risk of failure because of inadequate understandings of

these procedures. This is the essence of a study by Gott (1970). On the other hand, several of the PPBS theorists stress that systems analysis techniques have a great potential for increasing educational productivity (Hartley, 1968:91; Alkin, 1970; Curtis, 1971:201; Lonsdale, 1971:46; Haggart, 1972:153; Knezevich, 1973:174-178). To overcome the problems uncovered by Gott's study, new knowledge should be applied in order to improve the calibre of the available human resources.

An innovation is more likely to be organizationally feasibile when:

1. Reorganization is not a necessary condition of adoption.

2. Roles are clarified for people and machines.

3. Programs can be phased in with little disruption of students and other programs.

4. The innovation is equally effective in all areas of application.

5. Implementation of the innovation is not contingent upon special facilities or personnel.

6. Adopters of the innovation are involved in determining its application.

7. Adopters perceive a relative advantage in the innovation or it is perceived that self-interests are served.

8. Choice of implementation strategies is left to the adopters.

9. The innovation is: compatible with users' experience, easily understood, adoptable on the installment plan, and easily communicated to others.

These factors were assessed by Item 1 of Part II, Items 6a and 6b of Part III, and Items 18 - 26 of Part IV of the study questionnaire (Appendix B).

Technical Feasibility

> Technical feasibility. The extent to which technology (both system and mechanical) is available to accomplish a condition or occurrence which is regarded as theoretically feasible of being accomplished (Johnson & Shearon, 1970:6)

Technical feasibility as defined above, is determined on the basis of the availability of needed hardware (things) and software (processes).

The technical factors were assessed by Items 27 - 29 of Part IV of the study questionnaire (Appendix B).

Political Feasibility

> The political feasibility of a policy is the probability that it will be sufficiently acceptable to the various secondary decision-makers, executors, interest groups, and publics whose participation or acquiesence is needed, that it can be translated into action. Political feasibility depends on the power structure of the involved systems, and on the ability of the policy-makers and of the policy itself to recruit support (Dror, 1968:35).

Minimally, political feasibility involves meeting needs of society in general, and students in particular, in a way that does not conflict with social values and norms.

Ideally, a politically feasible alternative to current educational practice should not only enable each student to establish his own trajectory aimed at some distant long-range goal but it should also enable him to travel along that trajectory at his own speed. The more poorly defined the goal, and the more distant it lies in the future, the greater the

need for periodic trajectory modifications (Toffler, 1970:267; Worth, 1972:54). Moreover, a politically attractive alternative should serve all students; the gifted, the average, and the disadvantaged--especially the disadvantaged. There should be individual paths or trajectories for each student, not just a few paths which students pursue at different rates.

Self-motivation is valued highly by a wide sector of our society and a politically feasible educational approach should strive to develop autonomous learners (Meadows, 1968:29) How this might be brought about is discussed, in part, by Worth (1972:167):

> Two basic premises underlie proposals to involve the learner in a joint endeavor for the determination of objectives and the shaping of programs. One is that the learner must be trusted as a self-starting and self-motivated individual. The second is equally basic--respect for the learner as a person. We can ground these premises on more than simple faith. Trust and individual respect have already been identified as among the strongest factors in learner motivation. There is also support for the contention that learners who participate in program decisions develop a higher sense of destiny control, and perform better than average.

Accountability may also be a key factor in reckoning feasibility. Leon Lessinger (1970:217) has defined accountability:

> Accountability is the product of a process. At its most basic level, it means that an agent, public or private, entering into a contractual agreement to perform a service will be held answerable for performing according to agreed-upon terms, within an established time period, and with a stipulated use of resources and performance standards.

The political feasibility of an innovation is enhanced when:

1. The innovation is acceptable to those involved.

2. The needs of students and society are met in appropriate ways.

3. Students are treated as individuals and individual differences are considered in planning programs.

4. Students are enabled to become autonomous learners.

5. Accountability is evident.

With the exception of accountability, these factors were assessed by items 30 - 32 of Part IV of the study questionnaire (Appendix B).

Accountability is frequently regarded with bias. For that reason no specific questions were asked pertaining to accountability. On the other hand, by attending to Lessinger's definition of accountability, it can be seen that accountability is implicit in a number of questions in the questionnaire.

Pedagogical Feasibility

Pedagogical feasibility describes the extent to which an approach is educationally sound. A comprehensive listing of factors contributing to pedagogical feasibility was developed by Goodlad and Klein (1970:29-32) prior to their look "behind the classroom door". In summary, their factors asked:

1. What is the classroom climate?

2. How is the student brought into the subject matter? Is the teacher the source of information?

3. What do students study? Does it "grip" them?

4. What use is made of materials and equipment?

5. Is the teacher involved in the classroom activities?

6. What sorts of interactions occur? Teacher to child? Child to teacher? Child to child?

7. What is the nature of the child's inquiry?

8. How much independence do children have?

9. How well balanced is the curriculum?

10. How well are the textbooks, workbooks, and so forth, adopted to the immediate situation?

11. Do expectancies for achievment encompass the range of student differences?

12. Do teachers work independently?

Other factors also contribute to educational soundness.

1. Objectives of the educational program must be based on the needs of the students. The approach should be able to accommodate a variety of objective types: performance-, or experience-based; individual- or group-centered; cognitive, psychomotor, or affective.

2. Students should be provided with "advance organizers" (Ausubel, 1965:111).

3. Selection and organization of the curriculum must be accomplished in such a way as to avoid distortion of the body of knowledge under consideration. In other words, an approach should not be so inflexible as to require distortion in the body of knowledge being treated before it will function.

4. The selection and organization of the content of the curriculum must also take into account contributions from the various schools of learning theory and child development. Moreover, specialists (counselors, curriculum consultants,

librarians) should be able to make meaningful contributions to curricular decisions (Meadows, 1968:24; Connelly, 1973).

5. Selection of instructional methods should be compatible with various learning and motivation theory combinations.

6. Finally, evaluation should provide feedback data for both the student and the teacher. For the student the feedback data should provide a constant source of information concerning goals and progress. For the teacher the feedback should provide information pertaining to the effectiveness and efficiency of the instructional strategies and the curriculum.

To be pedagogically feasibile an innovation should:

1. Facilitate the meeting of students' needs.

2. Give students independence.

3. Give students direction and purpose in their studies.

4. Be applicable to a variety of subjects.

5. Take into account the many theories of learning and child development.

6. Provide for flexibility in choosing and applying instructional methods.

7. Provide evaluation feedback useful to both students and teachers.

These factors were assessed by items 1a, 1b, 1c, 1e, and 7 of Part III and Items 33 - 44 of Part IV of the study questionnaire (Appendix B).

Timeliness

Several of the studies already cited earlier in Chapter 2 assessed feasibility, at least in part, in terms of relevancy of the approach both now and into the foreseeable future. Stated another way, a change should be able to interface with known and anticipated constraints. Some of the current known and likely future constraints for educational programs are: PPBS, Electronic Data Processing (EDP), lifelong education, meeting individual's needs where they are and developing those individuals to the limit of their potential. Goodlad, O'Toole and Tyler (1966:14) identified one of the constraints on use of EDP in curriculum planning and implementation as the ability to break the curriculum into programmable modules.

These factors were assessed by items 2 - 4 of Part II and items 45 and 46 of Part IV of the study questionnaire (Appendix B).

Generalizability

The feasibility of a change or innovation is constrained to some extent by its generalizability. Generalizability of educational practices can be assessed along several dimensions: by levels (kindergarten, junior high, senior high); by subjects (art, science, mathematics); by content (cognitive, affective, psychomotor); and by practitioners (skilled, naive).

Generalizability was assessed in two ways.

1. Generalizability was assessed by items 5 - 14 of

Part II and Item 5 of Part III of the study questionnaire (Appendix B).

2. Information pertaining to current applications of the network-based approach was collected by Part VI of the study questionnaire (Appendix B).

Other Factors

Uncertainty. Because of the uncertainty surrounding the network-based approach (see Figure 3 on page 38) efficiency tests, as suggested by Thompson (1967:86), were considered not only inappropriate but virtually impossible to design. Parts II, III, and IV of the designed questionnaire most closely resemble instrumental tests. Instrumental tests serve to determine states that have been reached and objectives that have been achieved. "Efficiency tests" (Thompson, 1967:86) might have been expected to indicate the degree to which states had been reached and objectives achieved.

Beyond the assessment of the constraints to feasibility, other information was required to complete this study.

Demographic Data. Research question three (page13) necessitated collection of data upon which to subdivide the population in order to test for differences of opinion with respect to feasibility of the network-based approach. Beyond levels of experience and levels of training, which were believed capable of yielding differences in perceptions of educational feasibility, two other factors were identified in the literature.

1. Chin (1969:39-57) pointed to the part new knowledge plays in increasing the likelihood of innovation adoption. In this study new knowledge was believed to derive from in-services and from experience with the network-based approach. The latter gave rise to two subdivisions: adopters and observers; and, those who used the approach for planning and those who used the approach as a means for individualization of instruction.

2. Roles. Different roles within a hierarchy may result in differences of perception. Two such roles examined in this study are teachers and administrators.

The necessary data for identification of individuals in these subdivisions were collected in Part I of the study questionnaire (Appendix B) and by the initial survey used to identify study participants (Appendix A).

Research question four (page 13) necessitated collection of information pertaining to the utility of the procedure offered as a guide to development and implementation of a curriculum network. This information was collected by Items 1 - 3 of Part VI of the study questionnaire (Appendix B).

SUMMARY

Two steps of the study were completed in this chapter. A research design was developed. The research design was then expanded in order to: describe the sources of data upon which to base determination of feasibility; select a feasibility study method; and, develop assessment criteria for inclusion in the study questionnaire.

Chapter 4

STUDY METHODOLOGY

Overview

This study was designed to answer the question: "Can the network-based approach be used by classroom teachers to improve their classroom instruction?" An answer was sought in the answers to four research questions.

1. Is the network-based approach to curriculum development and implementation more effective and efficient than other alternatives known and used by teachers in managing instruction in their classrooms?

2. Is the network-based approach to curriculum development and implementation feasible for use in classrooms?

3. Is the perception of feasibility a function of: experience with the network-based approach; the hierarchical rank held by the respondents; or, other variables?

4. Is the procedure which was offered for use by teachers engaged in developing and implementing network-based curricula useful in its present form?

Answers to these research questions were derived from collected data pertaining to the feasibility criteria identified in Chapter 3. The source of data was teachers, administrators, and other educators who had experience with one or more of several network-based curriculm development and implementation projects.

This chapter consists of three sections: a description of the study population; a description of the data collection instrument; and, an outline of the data analysis plan.

THE STUDY POPULATION

Study Population Identification

The sources of data for this study were educators who have been involved in network-based curriculum development and implementation projects at the elementary, secondary, special, and post-secondary levels of education in the Edmonton area. Seventy three (73) questionnaires (Appendix A) were sent to potential participants in June 1974. Potential participants were those who could have had involvement with the network-based approach. Identification of participants took place by asking those known to be involved in network-based projects to name others who were involved. Forty six (46) responses were received. Of these five were returned by people who were involved in projects but chose not to participate. An additional sixteen (16) participants were identified after the initial survey thereby providing a potential study population of fifty seven (57) educators.

Fifty (50) people completed and returned their questionnaires--a return of 87.7 percent. Of the remaining seven, two people had left the province, four felt their experiences provided an inadequate base for judging the approach, and one returned the questionnaire after the data had been analyzed.

Study Population Subdivisions

For purposes of answering the third research question, the study population was initially subdivided into two major groups: those who adopted the network-based approach and those who observed the use of the network-based approach.

Adopters. Adopters were further divided into teachers and teacher-administrators. Teacher-administrators are commonly encountered at the elementary level. The adopter group was further partitioned on the basis of the use made of networks: some used networks as a means of developing individualized programs, others used them as the basis for planning more conventional instruction.

Observers. Observers were divided into two groups; administrators (assistant principals, principals, and Central Office and Department of Education personnel) and others (teachers, librarians, counselors, and specialists).

This subdivision, together with the number of participants in each group, is shown in Figure 4.

DATA COLLECTION INSTRUMENT AND IMPLEMENTATION PROCEDURES

Four kinds of data were required in order to answer the four research questions: data pertaining to the effectiveness and efficiency of the network-based approach; data pertaining to the feasibility of the approach; data upon which to test for differences of perception among subgroups; and, data pertaining to the utility of the procedure recommended for use in developing and implementing a network-based curriculum.

Figure 4

The Subdivision and Distribution of the Study Population

		Used the Networks as a Planning Guide	Used the Networks to Individualize Instruction
ADOPTERS	Teachers	(11)	(17)
	Teacher-Administrators	(4)	(2)
OBSERVERS	Administrators	(7)	
	Others	(9)	

Description of the Questionnaire

The questionnaire (Appendix B) was designed in six parts.

Part I. Part I was designed to collect the demographic data (as specified on pages 49 to 50) necessary to permit comparisons of feasibility perceptions among subgroups. Subgroups were initially formed on the basis of: the nature of involvement with the network-based approach (adopters, observers); use made of the networks (guide to planning, individualization); and, hierarchical rank (teachers, administrators).

Part II. Part II contains questions related to the timeliness and generalizability of the approach. Since these aspects had not been tested in practice they necessitated a theoretically derived response. The choice of item responses ranged from "clearly inferior" through "somewhat inferior", "uncertain", "somewhat superior", to "clearly superior". For those whose experiences with the network-based approach were limited, an "unable to answer" response was provided.

Part III. The criteria upon which the questions in Part III were based is discussed in Chapter 3. Claims that the network-based approach met some of these criteria was documented earlier (Hathaway, 1971:1-2). Part III was designed to determine the extent to which respondents agreed with those claims. The choice of item responses ranged from "strongly disagree" through "disagree", "uncertain", "agree", to "strongly agree". As in Part II, an "unable to answer" response was provided.

Part IV. Items 1 - 3, 5, 6, and 9 - 17 of Part IV were designed to determine the effectiveness and efficiency of the network based approach. The sources of these questions are discussed on pages 36 to 39. Items 4, 7, 8, and 18 to 46 sought to determine the feasibility of the approach. The sources of these quesions are discussed on pages 39 to 49. Response choices in Part IV were the same as those in Part III.

Part V. This part of the questionnaire was included so that respondents could provide additional information about their insights, observations, and general impressions of the network-based approach. All of these comments are included

in Appendix C.

Part VI. Part VI of the questionnaire was designed to collect information for two purposes: to evaluate the procedure for developing network-based projects; and, to obtain information describing the degree of generalization which has occurred in the operational projects.

The composition of the questionnaire is described in Table 1.

Reliability and Validity of the Questionnaire

The questionnaire was designed specifically for this study. Though desired levels of reliability and validity for the questionnaire were not specified in advance of questionnaire design, some specific steps were taken to avoid obtaining low levels of reliability and validity.

Reliability. Three steps to improving test reliability, discussed by Kerlinger (1964:442), were followed in so far as possible.

1. Ambiguity in the questionnaire items was reduced by submitting the questionnaire to teachers for appraisal, clarification of terms, and recommendations for modifications.

2. Reliability was increased by lengthening the questionnaire where possible in order to increase the number of items pertaining to each subtest.

3. Instructions for completing the questionnaire were simplified.

An analysis of the test revealed a reliability index of 0.93 based on the Kuder-Richardson 20 formula. A reliability index of 0.93 means that 86 percent of the total test

Table 1

Distribution of the Test Items Within the Study Questionnaire

			Part I	Part II	Part III	Part IV	Part V	Part IV
Feasibility Constraints	Quality	Effic.			1d,2-4	1-3,5, 6,9,10, 16,17		
		Effect.				11-15		
	Organizational			1	6	18-26		
	Technical					27-29		
	Political					30-32		
	Pedagogical				1a,b,c, e,7	4,7,8, 33-44		
	Timeliness			2-4		45-46		
	Generaliz-ability			5-14	5			4,5
	Procedure Utility							1-3
	Demographic		All					
	Observations						All	
				Theor.	Operational			
				Feasibility Determination Planes				

variance is accounted for by the test--14 percent being attributed to other factors.

Validity. Validity, according to Kerlinger (1964:442), may be partitioned into four types: predictive, concurrent, construct, and content.

Concurrent and predictive validity attempt to determine correlates of the test with respect to time--now (in comparison to other tests) and in the future (by comparing predicted results with actual). These validity components were not treated in this feasibility study because to do so would require:

1. Correlation of the results of the study questionnaire with the results of other instruments (concurrent validity).

2. Comparison of feasibility predictions derived from the study with the actual results of one or more implementation attempts (predictive validity).

Construct validity was not considered a crucial factor since attempts were not made to explain the variance of test scores. Content validity was treated as relevant because it is concerned with asking questions which are representative of the domain of interest. A fifth factor, face validity, was also of concern in as much as questionnaires should appear to be probing what they claim to probe. Had the questionnaire appeared to be an evaluation of the study participants, for example, the results may have been distorted.

For this questionnaire, content validity was attended to by developing questionnaire items specifically designed

to probe criteria pertaining to each of the feasibility constraints. Face validity was established by first submitting the questionnaire to an analysis by a subgroup of the study population.

Study Bias

Two types of bias were encountered in this study: bias introduced by the designer of the study and bias introduced by the respondents to the study questionnaire.

Efforts to reduce designer bias included:

1. Adhering to the literature review as the basis for definition of factors constraining feasibility.

2. Adhering to the literature review as the basis for setting the criteria by which the constraining factors were assessed.

Respondent bias may result from two factors:

1. The Hawthorne effect.

2. Respondents were asked to judge an approach they had already adopted. Cognitive dissonance (Festinger, 1964: 512) could have been a factor.

No specific steps were taken to avoid these two forms of respondent bias. Consquently, results of the study must be treated cautiously.

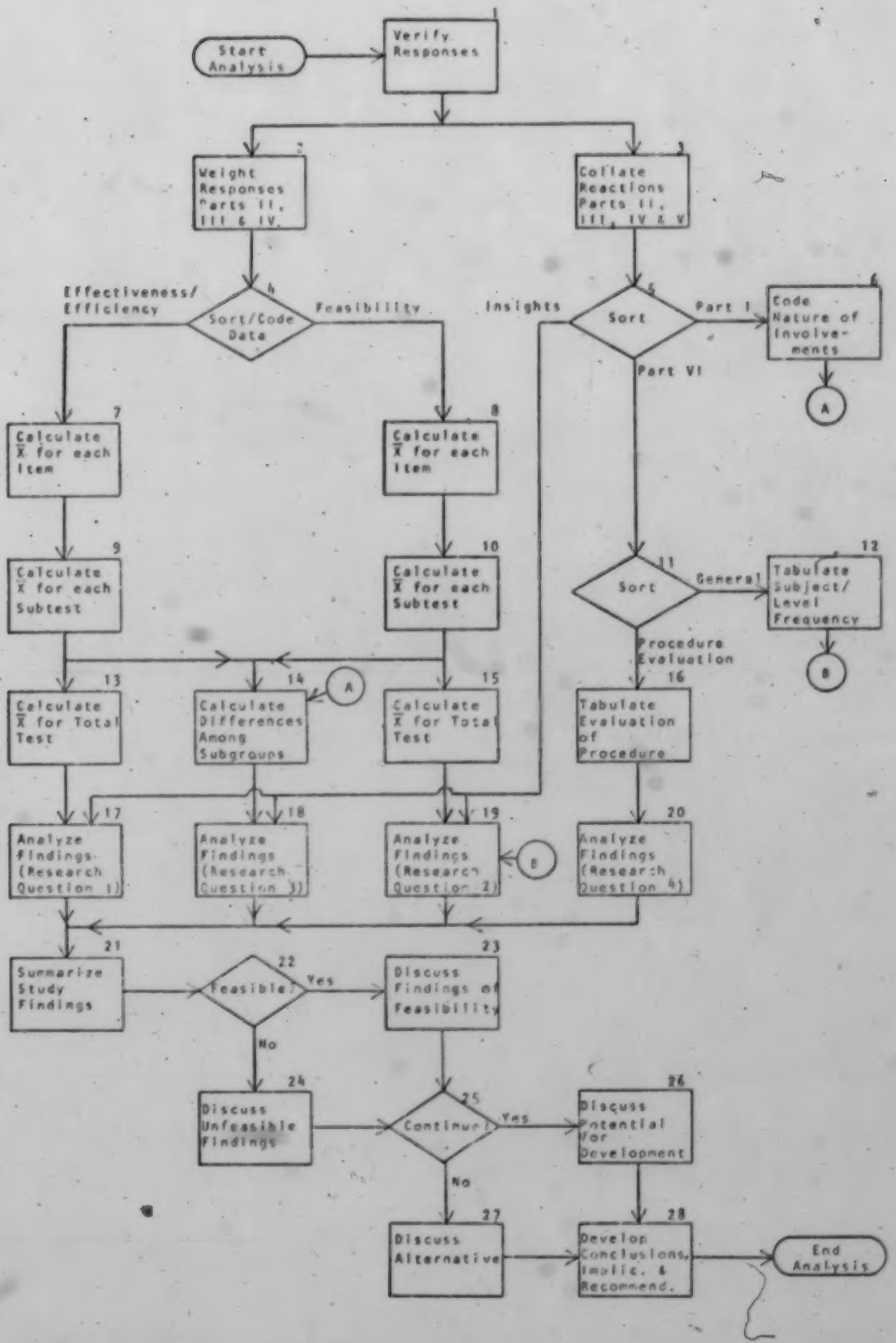
DATA ANALYSIS PLAN

Analysis Plan Summary

The data analysis plan employed in this study is summarized in flowchart form in Figure 5. Each function on the flow chart is numbered with the numbers serving as a key

Figure 5

Data Analysis Plan



to the following discussion.

Discussion of the Analysis Plan

Function 1. Each questionnaire was checked for ambiguous responses or responses that were omitted without explanation. Unexplained omissions (particularly in Part I) were followed up by interview or telephone. As a result of this step no questionnaires were rejected--none was excluded from analysis.

Function 2. The responses to items in Parts II, III, and IV were weighted. Parts II and IV were weighted as follows:

Clearly inferior	1
Somewhat inferior	2
Uncertain	3
Somewhat superior	4
Clearly superior	5
Unable to answer	not tabulated

Part III of the questionnaire was weighted as follows:

Strongly disagree	1
Disagree	2
Uncertain	3
Agree	4
Strongly agree	5
Unable to answer	not tabulated

"Unable to answer" responses were excluded from analytical calculations. The decision was made so that a more precise assessment of feasibility or unfeasibility could be obtained. For example: in a case where 20 or 40 respondents felt capable of expressing an opinion, 10 may have

taken a clear position and 10 may have been uncertain. On the basis of the analysis it could be said that 50 percent of those who felt knowledgeable held a clear view rather than saying that 25 percent of the total study group held a clear view. Moreover, it could also be said that 50 percent of the population lacked sufficient information to formulate an opinion.

Function 3. Respondents were encouraged to justify their extreme viewpoints. All of these justifications were collected and are included in Appendix C. Parts I and VI were readied for subsequent sorting and analysis.

Function 4. The weighted responses from parts II, III, and IV were transferred to computer cards and the required computer programs specified in order to compute item, subtest, and test mean scores together with an analysis of variance among subgroups.

Function 5. Material from Function 3 was sorted into three categories: Part I; reactions to questions contained in Parts II, III, or IV; and, Part VI.

Function 6. Data contained in the first questionnaire (appendix A) and Part I of the study questionnaire were used to classify the respondents into the subgroups specified in Function 14.

Function 7. The mean score for each item in the effectiveness and efficiency subtests was calculated. As noted in Function 2, responses of "Unable to answer" were excluded from calculations of the mean score.

Function 8. The mean score for each item in the feasibility subtests was calculated. These subtests focused on the organizational, technical, political, pedagogical, timeliness, and generalizability constraints of feasibility. As noted in Function 2, responses of "unable to answer" were excluded from calculations of the mean score.

Function 9. Mean scores for the effectiveness and efficiency subtests were calculated. The mean scores for each subtest were also calculated for each respondent and used in testing for significant differences in Function 14.

Function 10. A mean score for each of the feasibility subtests was calculated. Mean scores for the feasibility subtests were also calculated for each respondent and used in testing for significant differenced is Function 14.

Function 11. Data pertaining to the degree of generalization attained by the network-based approach was sorted from data pertaining to the utility of the procedure for developing network-based curricula.

Function 12. Generalizability data were tabulated by educational level of use and by subject (for example: elementary, math; senior high, technical).

Function 13. The mean score was calculated for the effectiveness and efficiency test (combined subtests).

Function 14. Using individual subtest scores from Functions 9 and 10 the data were analyzed for significant differences of opinion among the following groups:

-adopters, observers.

-teachers, teacher-administrators, administrators,

others.

-those who used the approach for planning, those who used the approach for individualization.

A multiple discriminant analysis (Appendix D) was used to cluster respondents on the basis of commonalities in their patterns of responses to the study questionnaire. The multiple discriminant analysis suggested the following subgroups which were also analyzed for significant differences of opinion:

-academic training, industrial/vocational training.

-regular educators, remedial educators, externals.

-academic/regulars, academic/remedials, technical/remedials, externals.

-training (four years or less, more than four years).

-perceptions of self-interest and relative advantage (low, medium, high) based on the average score for Item 1, Part II and Item 19, Part IV.

The following is a description of each subgroup:

Adopters. Adopters are teachers who used a curriculum network.

Observers. Observers are teachers and administrators who had observed on-going network-based projects.

Teachers. Teachers are those who are involved in classroom activities on a full-time basis.

Teacher-administrators. Teacher-administrators are those who teach part-time and serve as a principal or assistant principal for the remainder of the time.

Administrators. Administrators include full time principals and assistant principals as well as Central

Office and Department of Education personnel.

Others. Others include teachers (not involved in network projects), librarians, counselors, and specialists.

Planning. Planning includes all teachers who use the networks as a base for planning and organizing conventional instruction.

Individualizing. Included are those teachers who use networks as a means of individualizing instruction.

Academics. Academics includes educators whose undergraduate and graduate training was in any field except industrial arts and vocational education.

Technicals. This group includes educators whose undergraduate or graduate training was in in industrial arts or vocational education.

Regulars. Regulars are those educators primarily involved in regular educational programs.

Remedials. Remedials are those educators primarily involved in remedial and special education.

Externals. Externals are those educators who occupy positions in Central office, the Department of Education, or the University.

Academic/Regulars. Included are those educators who are academically trained and involved in remedial and special education programs.

Technical/Remedials. This group includes those who have industrial/vocational teacher training and are involved in remedial and special education programs.

Training: four years or less. Included are those

educators who have four years, or less, of teacher training.

Training: more than four years. Included are those who have training beyond four years.

Low Advantage. Included are those educators whose average score for Items 1, Part II and 19, Part IV was less than 3.0.

Medium Advantage. Included are those whose average score for Items 1, Part II and 19, Part IV ranged from 3.0 to 3.99.

High Advantage. Included are those whose average score for Items 1, Part II and 19, Part IV was 4.0 or higher.

Significant differences between subgroup pairs were determined by a t-test. When three or more groups were involved an F-test was used to detect a significant difference and the Scheffé Multiple Comparison of Means test was used to determine the direction of the difference.

Though non-parametric procedures would have been justified in this study because of the impossibility of meeting the constraints of normality and homogeneity of variance cited by Kerlinger (1964:257-260), the analysis of variance procedures were chosen because they are relatively unaffected by non-normality and heterogenous variance (Ferguson, 1971:157; Glass, Peckham & Sanders, 1972: 237-288) and are readily available. It must also be noted that the purpose of the tests was to determine if there were gross differences in perceptions among subgroups--to find polarization of views rather than minor divergences. Another alternative would have been to use graphs, noting both

congruency of patterns and differences of level.

For the *t*-test and *F*-test a level of significance of 0.05 was chosen. Because the Scheffé test is a conservative test it was used at the 0.1 level of significance (Ferguson, 1971:271; Kerlinger, 1964: 199).

Function 15. The mean score was calculated for the feasibility test (combined feasibility subtests).

Functions 16. The items of Part VI which evaluated the procedure for applying the network-based approach were tabulated.

Function 17. The findings of effectiveness and efficiency were summarized in preparation for answering the first research question.

Function 18. The findings of differences in perception were summarized in preparation for answering the third research question.

Function 19. The findings of feasibility were summarized in preparation for answering the second research question.

Function 20. The evaluations of the procedure for applying the network-based approach were summarized in preparation for answering the fourth research question.

Function 21. Data pertaining to the four research questions were integrated in preparation for answering the study problem.

Function 22. Judgements were made about aspects of the network-based approach by applying the following test to the subtest scores.

Feasible	Mean score > 3.5
Marginal	Mean score > 2.5 and < 3.5
Unfeasible	Mean score < 2.5

Function 23. The significance of the feasible dimensions of the approach was assessed and implications considered.

Function 24. The significance of the unfeasible dimensions of the approach was assessed and the implications considered.

Function 25. A decision was made regarding recommendations for further development of the network-based approach. Part of the decision was made by applying the following test to the total test mean score:

Feasible	Mean score > 3.5
Marginal	Mean score > 2.5 and < 3.5
Unfeasible	Mean score < 2.5

The remainder of the decision was made in light of the strengths and weaknesses discernible from Function 22.

Function 26. The potential for further development was explored together with the problems and pitfalls of further development.

Function 27. Alternatives to the weak and unfeasible aspects of the approach were explored.

Function 28. On the basis of the data analysis in Chapter 5 conclusions to the study were summarized and are presented in Chapter 6.

SUMMARY

In this chapter three dimensions of the study have been discussed: the study population; the study instrument; and the data analysis plan. The analysis of the data is discussed in the next chapter.

Chapter 5

FINDINGS, DISCUSSION, AND CONCLUSIONS

Overview

Four research questions were used as stepping stones in answering the problem addressed by this study. As discussed in Chapter 3, data were collected from a study population composed of 34 educators who have adopted the network-based approach and 16 educators who observed adoption and use of the approach. In this chapter the findings are presented, discussed, and conclusions drawn for each of the four research questions.

The data upon which all subsequent discussion is based are contained in Appendices B and C. Appendix B contains the study questionnaire, the item mean scores, and the response patterns for each item. Appendix C contains all of the participants' comments offered in response to Item 15, Part II; Item 8, Part III; Item 47, Part IV; and Part V of the questionnaire.

Tabulation of the questionnaire responses (Appendix B) from those who felt capable of expressing an opinion indicates that 2.89 percent of the responses fell into the unfeasible range (1 to 2) while 76.57 percent fell into the feasible range (4 to 5). Uncertainty (3) was expressed in 20.54 percent of the responses (Table 2). On the basis of this analysis it can be seen that low scores may be more indicative of uncertainty than perceived unfeasibility.

Table 2

A Summary of the Responses to Parts II, III, and IV of the Study Questionnaire

Response Weight	Part II	Part III	Part IV	Sum of Responses	Percent of Analyzed Responses	Percent of Total Responses
1	1	0	13	14	0.40	0.35
2	10	22	55	87	2.49	2.20
3	133	104	482	719	20.54	18.20
4	245	278	921	1444	41.26	36.56
5	200	233	803	1236	35.31	31.29
Total Analyzed Responses	589	637	2274	3500	100.00	88.60
Unable to Answer	111	63	276	450		11.40
Total Responses	700	700	2550	3950		100.00

EFFECTIVENESS AND EFFICIENCY

The first research question asked: "Is the network-based approach to curriculum development and implementation more effective and efficient than other alternatives known and used by teachers in managing instruction in their classrooms?"

Findings

Effectiveness and efficiency were assessed by separate subtests and then combined to derive an overall effectiveness and efficiency score. These scores are presented in Table 3. Table 4 identifies comments contained in Appendix C which pertain to effectiveness and efficiency.

Discussion

Effectiveness. Based on questionnaire items defined as representative of effectiveness and on an average score of 4.37, study participants appear to be of the opinion that the network-based approach is more effective than other alternatives known to them. Highest scores were associated with items pertaining to the capability of the network-based approach for: developing clear statements of goals and objectives; eliminating redundancies in the curriculum; and, integrating curriculum fragments into a whole.

Efficiency. Based on items defined as representative of efficiency and on an average score of 4.07 study participants appear to be of the opinion that the network-based approach is more efficient than other alternatives known to them Scoring highest were those items pertaining to: more

Table 3

Mean Scores for Effectiveness and Efficiency Subtests

Test	Mean Score	Stand. Dev.	N
Effectiveness	4.37	0.53	46
Efficiency	4.07	0.46	47
Combined	4.21	0.43	45

Table 4

Identification of Comments Contained In Appendix C Which Pertain to Effectiveness and Efficiency

Effectiveness		Efficiency	
Con	Pro	Con	Pro
	T5,T9,T12 T15,CO1	T13,VP4	T1,T2,T5,T7 T9,T11,T12 T14,T15,VP2 C2,PR1,PR2

T- Teacher
CO- Central Office Administrator
C- Counsellor
VP- Vice-Principal
PR- University Professor

efficient use of resources such as equipment, materials, and supplies; better student records; relatively low amounts of in-service required to introduce teachers to the approach; and, the ability to pinpoint curricular areas requiring revision. Study participants were less certain that: students were more productive in network-based programs; there was a reduction in the amount of time spent in storing the retrieving student records, instructional materials; and conversely, more time was available to spend with students.

Conclusions

The mean scores for effectiveness (4.37) and efficiency (4.07) fall within the range of 3.5 to 5.0 established as an indication of feasibility (see Function 22, page 67). In addition, the ratio of positive comments to negative comments (Table 4, page 73) appears to correlate with these indications of feasibility.

On the basis of the findings it can be concluded that the study population perceived the network-based approach to curriculum development and implementation to be more effective and efficient than other alternatives known to them.

FEASIBILITY

The second research question asked: "Is the network-based approach to curriculum development and implementation feasible for use in classrooms?"

Findings

Feasibility was assessed by six subtests of the study questionnaire. Each subtest was composed of items defined as

representative of one of the constraints to feasibility: organizational, technical, political, pedagogical, timeliness and generalizability. The scores for each of the subtests together with the score for the total test (combined subtests) are presented in Table 5. Table 6 identifies comments contained in Appendix C which pertain to the feasibility constraints.

Organizational constraints. The average score for the organizational subtest was 4.00. Among the questionnaire items which scored highest were those suggesting that: distinct advantages were offered to both students and teachers; the network-based approach may be easily applied in a variety of organizational settings; and, it involves teachers in all stages of curriculum development, that is: identifying the problems, setting objectives, creating alternatives, selecting best alternatives, implementation, and evaluation. The study population expressed more uncertainty in their responses to items pertaining to: role clarification; need for reorganization; and, flexibility in determining how objectives are to be achieved.

Technical constraints. The mean score for the technical subtest was 3.16 on a scale of 1 to 5. Only 29 members of the study population (58 percent) responded to items in the technical subtest--the remainder were unable to answer.

Political constraints. The mean score for the political subtest was 4.39--the highest score in the feasibility set.

Table 5

Mean Scores for the Feasibility Subtests

Subtest	Mean Score	Stand. Dev.	N
Organizational	4.00	0.48	45
Technical	3.16	0.94	29
Political	4.39	0.54	47
Pedagogical	4.11	0.42	43
Timeliness	4.06	0.57	29
Generalizability	4.16	0.51	43
Combined test	3.81	0.41	50

Table 6

Identification of Comments Contained in Appendix C Which Pertain to Feasibility

Organ.		Tech.		Pol.		Pedag.		Time		Gen.	
Con	Pro	Con	Pro	Con	Pro	Con	Pro	Con	Pro	Con	Pro
P2	T15				L1	T2	T3		PR2	T8	T9
	P1				PR1	T7	T4				P2
						T11	T6				C2
						VP1	T7				
						VP2	T10				
						VP4	T15				
						C1	DH1				
							VP1				
							VP3				

T- Teacher
DH- Department Head
VP- Vice-Principal
P- Principal
L- Librarian
C- Counsellor
PR- University Professor

Pedagogical constraints. The mean score for the pedagogical subtest was 4.11. The highest scoring items pertained to such factors as the capability of the network-based approach to: provide students with an overview of a course; facilitate student evaluations on the basis of their performance; and, accommodate both individualized and group-centered objectives. More uncertainty was apparent in responses to items which pertained to: student self-images; the ability of the network-based approach to integrate contributions from a number of specialists into the curriculum; and, enhanced insights into student behaviors which should be evaluated.

Timeliness. Only 58 percent of the study population responded to the timeliness subtest. The average of these responses was 4.06. The greatest degree of uncertainty pertained to those items concerned with PPBES and Electronic Data Processing.

Generalizability. The mean score for the generalizability subtest was 4.16. Data collected in Part VI of the study questionnaire describes the extent to which the network-based approach has been put into practice by the study participants. Table 7 presents a summary of the collected data.

Discussion

Feasibility was assessed on the basis of six subtests. Of these subtests, the responses to the technical and timeliness subtests are of particular interest.

The technical and timeliness subtests contained items to which 42 percent of the study population felt they could not respond. Most of the respondents who offered a reason for

Table 7

Distribution of Network-based Curriculum Participants by Subject Area and Academic Level of Involvement

Subject \ Academic Level	Elem.	Junior High	Senior High	Sp. Ed.	Univ.	Total
Language Arts	11			5		16
Science			1			1
Fine Arts						
Business Education						
Mathematics	10		1	7		18
Physical Education						
Second Languages						
Social Sciences						
Home Economics				1		1
Technical Education		1	3		2	6
Industrial Arts		1	1		3	5
Options	1					1
Total	22	2	6	13	5	48

an "Unable to Answer" response indicated that it was due to a lack of information or experience. PPBES and Electronic Data Processing were frequently cited as specific concepts about which information was lacking.

Conclusions

With one exception the mean score for each of the feasibility subtests fell within the range of 3.5 to 5.0 established as an indication of feasibility (see Function 22, page 67). The exception was the mean score for the technical subtest (3.16) which placed it in the marginal category. The combined feasibility subtests yielded a mean score of 3.81 which again falls within the specified limits of feasibility. The analyzed data also revealed 14 instances where the network-based approach has been put into practice by members of the study population.

On the strength of the findings pertaining to feasibility it can be concluded that the study participants perceived the network-based approach to be more feasible for use in classrooms than other alternatives known to them.

DIFFERENCES IN PERCEPTION

The third research question asked: "Is the perception of feasibility a function of: experience with the network-based approach; the hierarchical rank held by the respondent; or, other variables?"

Findings

On the basis of subtest scores, comparisons of the

subgroups identified in Function 14 of the Analysis Plan (pages 63 to 67) were made using either a t-test for two subgroups or an F-test followed by a Scheffé Multiple Comparison of Means test for three or more groups. The t-test or F-test served to establish the level of significance of the differences and the Scheffé Multiple Comparison of Means test served to determine the direction of the differences.

Study groups. As reflected in Tables 8 to 13 the only significant difference of opinion among the subgroups identified in Figure 4 (page 54) and on the basis of the collected domographic data emerged as a result of differences in teaching experience.

To examine the effects of differences in teaching experience the study population was divided into three nearly equally sized groups: those with seven or less years of experience those with eight to eleven years of experience, and those with twelve or more years of experience. The average level of experience in the study population was 10.7 years. As reflected in Table 13; significant differences in perceptions were found with respect to the efficiency, organizational and timeliness constraints of feasibility.

The Scheffé test (Table 14) indicates that the High Experience group scored significantly higher than others in perceptions of feasibility.

The Scheffé test (Table 15) indicates that the High Experience group perceived the network-based approach to be less constrained organizationally (more organizationally feasible) than the Low Experience group.

Table 8

A Comparison of Perceptions of Feasibility Between 'Adopters' and 'Observers'

Subtest	Adopters N = 34 $\bar{X}$	Observers N = 16 $\bar{X}$	Average N = 50 $\bar{X}$
Effectiveness	4.34	4.46	4.38
Efficiency	4.03	4.15	4.07
Organizational	4.00	4.00	4.00
Technical	3.17	3.15	3.16
Political	4.32	4.53	4.39
Pedagogical	4.12	4.09	4.11
Timeliness	3.99	4.18	4.06
Generalizability	4.17	4.13	4.16

Differences are not significant at the 0.05 level as determined by a *t*-test.

Adopters- those who have adopted the network-based approach.

Observers- those who have observed adoption.

Table 9

A Comparison of Perceptions of Feasibility Among 'Teachers', 'Teacher-Administrators', 'Administrators', and 'Others'

Subtest	Teachers N = 28 $\bar{X}$	Teach-Admin N = 6 $\bar{X}$	Admin N = 7 $\bar{X}$	Others N = 9 $\bar{X}$	Average N = 50 $\bar{X}$
Effectiveness	4.33	4.40	4.51	4.40	4.38
Efficiency	4.07	3.87	4.20	4.11	4.07
Organizational	4.04	3.82	4.08	3.91	4.00
Technical	3.27	2.75	2.92	3.33	3.16
Political	4.33	4.25	4.68	4.41	4.39
Pedagogical	4.12	4.09	4.14	4.02	4.11
Timeliness	4.02	3.93	4.49	3.65	4.06
Generalizability	4.23	3.94	4.10	4.16	4.16

Differences are not significant at the 0.05 level as determined by an F-test.

Teachers- those who spend most of their time in a classroom.

Teacher-administrators- principals and vice principals who teach part of the time.

Administrators- those who devote all of their time to administration within a school.

Others- included are teachers (who have not adopted the netowrk-based approach), librarians, counsellors, and curricular specialists.

Table 10

A Comparison of Perceptions of Feasibility Between those Using Networks for 'Planning' and Those Using Networks for 'Individualizing' Instruction

Subtest	Planning N = 13 $\bar{X}$	Individ. N = 19 $\bar{X}$	Average N = 32 $\bar{X}$
Effectiveness	4.38	4.32	4.34
Efficiency	3.93	4.08	4.03
Organizational	3.79	4.13	4.00
Technical	2.76	3.38	3.17
Political	4.15	4.43	4.32
Pedagogical	4.02	4.18	4.12
Timeliness	4.03	3.94	3.99
Generalizability	4.00	4.27	4.17

Differences are not significant at the 0.05 level as determined by a t-test.

Planning- those who used networks for planning instruction.

Individualizing- those who use networks as a means of individualizing instruction.

Table 11

A Comparison of Perceptions of Feasibility Based on Years of Training

Subtest	Training ≤ 4 yrs N = 22 $\bar{X}$	Training > 4 yrs N = 26 $\bar{X}$	Average N = 48 $\bar{X}$
Effectiveness	4.27	4.47	4.38
Efficiency	3.99	4.14	4.07
Organizational	3.89	4.08	4.00
Technical	3.38	2.97	3.16
Political	4.31	4.45	4.39
Pedagogical	4.07	4.15	4.11
Timeliness	3.80	4.22	4.06
Generalizability	4.10	4.21	4.16

Differences are not significant at the 0.05 level as determined by a t-test.

Table 12

A Comparison of Perceptions of Feasibility Based on Levels of Experience with The Network-Based Approach

Subtest	Low N = 22 $\bar{X}$	Medium N = 15 $\bar{X}$	High N = 11 $\bar{X}$	Average N = 48 $\bar{X}$
Effectiveness	4.28	4.44	4.47	4.38
Efficiency	4.10	3.95	4.18	4.07
Organizational	3.95	3.97	4.11	4.00
Technical	3.33	2.96	3.08	3.16
Political	4.32	4.41	4.47	4.39
Pedagogical	3.99	4.18	4.23	4.11
Timeliness	3.86	4.13	4.26	4.06
Generalizability	4.16	4.04	4.30	4.16

Differences are not significant at the 0.05 level as determined by an F-test.

Low- network-based experience < 3.0 years.

Med- network based experience ≥ 3.0 years and < 4.0 years.

High- network-based experience ≥ 4.0 years

Table 13

A Comparison of Perceptions of Feasibility Based on Levels of Teaching Experience.

Subtest	Low N = 15 $\bar{X}$	Medium N = 17 $\bar{X}$	High N = 16 $\bar{X}$	Average N = 48 $\bar{X}$
Effectiveness	4.27	4.29	4.59	4.38
Efficiency*	3.94	3.93	4.37[a]	4.07
Organizational*	3.77	4.02	4.21[b]	4.00
Technical	3.63	2.95	3.05	3.16
Political	4.30	4.27	4.61	4.39
Pedagogical	4.02	4.03	4.29	4.11
Timeliness*	3.74	3.89	4.55[c]	4.06
Generalizability	4.09	4.05	4.37	4.16

*Differences are significant beyond the 0.05 level as determined by an F-test.

[a]Differs from Low and Medium experience groups.

[b]Differs from Low experience group.

[c]Differs from Low and Medium experience groups.

Low- teaching experience < 7.0 years.

Med- teaching experience ≥ 7.0 years and < 11.0 years.

High- teaching experience ≥ 11.0 years.

Table 14

A Scheffé Multiple Comparison of Mean Scores Obtained by 'High Experience', 'Medium Experience', and 'Low Experience' Groups on the Efficiency Subtest

Groups	Low	Med.	High
Mean Scores	3.94	3.93	4.37
Low Experience	----	0.996	0.029*
Medium Experience	0.996	-----	0.193
High Experience	0.029*	0.193	----

*Differences are significant beyond the 0.1 level.

Table 15

A Scheffé Multiple Comparison of Mean Scores Obtained by 'High Experience', 'Medium Experience', and 'Low Experience' Groups on the Organizational Subtest

Groups Mean Scores	Low 3.77	Med. 4.02	High 4.21
Low Experience	----	0.343	0.045*
Medium Experience	0.343	----	0.510
High Experience	0.045*	0.510	----

*Differences are significant beyond the 0.1 level.

The Scheffé test (Table 16) indicates that the High Experience group regarded the approach as significantly more timely than do the other two groups.

Multiple discriminant analysis groups. As discussed in Function 14 of the Analysis Plan (pages 63 to 67), a multiple discriminant analysis was used to identify variables which could lead to polarization of perceptions. Emergent were the following factors:

- teacher preparation programs (Academic, Technical),
- work setting (Regular classroom, Remedial classroom, External to the school),
- and combined (Academic/Regular, Academic/Remedial, Technical/Remedial, and External).

It must be noted that there were no Technical/Regulars in the study population. Each of these new divisions of the study population lead to significant differences of opinion.

1. Teacher preparation programs.

When the study population was divided into Academics and Technicals, a difference of opinion occurred with respect to the technical constraint to feasibility. The Academics perceived the approach as less constrained technically than did the Technicals (Table 17).

2. Work setting.

On the basis of a division of the study population on the basis of work setting, significant differences of opinion occurred with respect to efficiency, political, and timeliness constraints to feasibility (Table 18).

The Scheffé test (Table 19) indicates that the Regulars

Table 16

A Scheffé Multiple Comparison of Means Score Obtained by 'High Experience', 'Medium Experience', and 'Low Experience' Groups on the Timeliness Subtest

Groups Mean Scores	Low 3.74	Med. 3.89	High 4.55
Low Experience	----	0.814	0.012*
Medium Experience	0.814	----	0.018*
High Experience	0.012*	0.018*	----

*Differences are significant beyond the 0.1 level.

Table 17

A Comparison of Perceptions of Feasibility Based on Different Teacher-Training Programs

Subtests	Academics N = 32 $\bar{X}$	Technicals N = 11 $\bar{X}$	Average N = 43 $\bar{X}$
Effectiveness	4.35	4.35	4.34
Efficiency	4.04	3.97	4.01
Organizational	3.98	3.93	3.97
Technical*	3.45	2.52	3.21
Political	4.30	4.48	4.35
Pedagogical	4.05	4.16	4.08
Timeliness	3.96	3.89	3.94
Generalizability	4.11	4.16	4.12

*Differences are significant beyond the 0.05 level as determined by a t-test.

Academics- those prepared to instruct any subjects except Industrial Arts and Vocational Education.

Technicals- those prepared to instruct Industrial Arts or Vocational Education

**Five sets of responses were excluded from this analysis because of insufficient demographic data.

Table 18

A Comparison of Perceptions of Feasibility Based on Different Work Settings

Subtests	Regulars N = 29 $\bar{X}$	Remedials N = 14 $\bar{X}$	Externals N = 5 $\bar{X}$	Average N = 48 $\bar{X}$
Effectiveness	4.26	4.39	4.64	4.38
Efficiency*	3.80[a]	4.12	4.48	4.07
Organizational	3.79	4.05	4.23	4.00
Technical	2.96	3.32	2.50	3.16
Political*	4.10[b]	4.47	4.70	4.39
Pedagogical	3.94	4.15	4.35	4.11
Timeliness*	3.87	3.99	4.80[c]	4.06
Generalizability	3.91	4.21	4.48	4.16

*Differences are significant beyond the 0.05 level as determined by an F-test.

[a]Differs from Remedial and Externals.

[b]Differs from Remedials and Externals.

[c]Differs from Regulars and Remedials.

Regulars- those working in regular classrooms and schools.

Remedials- those working in remedial classrooms and schools.

Externals- those working outside schools.

Table 19

A Scheffe Multiple Comparison of Mean Scores Obtained by 'Remedials', 'Regulars', and 'Externals' on the Efficiency Subtest

Groups Mean Scores	Remedial 3.80	Regular 4.12	External 4.48
Remedial	----	0.083*	0.219
Regular	0.083*	----	0.013*
External	0.219	0.013*	----

*Differences are significant beyond the 0.1 level.

scored significantly lower than the other groups on the efficiency subtest.

The same pattern occurred with respect to perceptions of the political constraint. Regulars scored significantly lower than other groups (Table 20).

The Externals scored significantly higher than either of the other subgroups with respect to timeliness of the network-based approach (Table 21)

3. Combined effects.

When the effects of the teacher preparation programs and the work settings were combined three areas of significant difference emerged. They pertained to the efficiency, technical, and timeliness constraints to feasibility (Table 22).

The Scheffé test (Table 23) indicates that the Externals and Academic/Remedials scored significantly higher than the Academic/Regulars.

The Academic/Remedials scored significantly higher than the Technical/Remedials on the technical constraint (Table 24).

Finally, the Externals scored significantly higher than the Technical/Remedials and Academic/Regulars on the timeliness dimension (Table 25).

Relative advantage. Because both Rogers (1962:124-133) and Chin (1967:39-57) considered self-interest or relative advantage to be a variable influencing adoption, this variable was used to divide the study population into three groups. The High Advantage group consisted of those whose

Table 20

A Scheffé Multiple Comparison of Mean Scores Obtained by 'Remedials', 'Regulars', and 'Externals' on the Political Subtest

Groups Mean Scores	Remedial 4.10	Regulars 4.47	Externals 4.70
Remedials	----	0.091*	0.675
Regulars	0.091*	----	0.092*
Externals	0.675	0.092*	----

*Differences are significant beyond the 0.1 level.

Table 21

A Scheffe Multiple Comparison of Means Scores Obtained by 'Remedials', 'Regulars', and 'Externals' on the Timeliness Subtest

Groups Mean Scores	Remedials 3.87	Regulars 3.99	Externals 4.80
Remedials	----	0.832	0.034*
Regulars	0.832	----	0.018*
Externals	0.034*	0.018*	----

*Differences are significant beyond the 0.1 level.

Table 22

A Comparison of Perceptions of Feasibility Based on the Combined Effects of Different Teacher-Training Programs and Work Settings

Subtests*	Ac/Reg N = 14 $\bar{X}$	Ac/Rem N = 18 $\bar{X}$	Tech/Rem N = 11 $\bar{X}$	External N = 5 $\bar{X}$	Average N = 48 $\bar{X}$
Effectiveness	4.25	4.44	4.33	4.64	4.38
Efficiency*	3.80[a]	4.21	3.97	4.48	4.07
Organizational	3.79	4.13	3.93	4.23	4.00
Technical*	2.96	3.77[b]	2.52	2.50	3.16
Political	4.10	4.47	4.48	4.70	4.39
Pedagogical	3.94	4.14	4.16	4.35	4.11
Timeliness*	3.87	4.09	3.89	4.80[c]	4.06
Generalizability	3.91	4.24	4.16	4.48	4.16

*Differences are significant beyond the 0.05 level as determined by on F-test.

[a]Differs from Academic/Remedials and Externals.

[b]Differs from Technical/Remedials.

[c]Differs from Technical/Remedials and Academic/Regulars.

Ac/Reg- Academically prepared personnel in regular classrooms or schools.

Ac/Rem- Academically prepared personnel in remedial classrooms or schools.

Tech/Rem- Industrial Arts and Vocational Education personnel in remedial classrooms or schools.

Externals- those working outside schools.

Table 23

A Scheffé Multiple Comparison of Mean Scores Obtained by 'Academic/Regulars', Academic/ Remedials', 'Technical/Remedials', and 'Externals' on the Efficiency Subtest

Groups Mean Scores	Ac/Reg. 3.80	Ac/Rem. 4.21	Tech/Rem. 3.97	Ext. 4.48
Academic/Regular.	----	0.073*	0.792	0.030*
Academic/Remedial	0.073*	----	0.522	0.648
Technical/Remedial	0.792	0.522	----	0.174
Externals	0.030*	0.648	0.174	----

*Differences are significant beyond the 0.1 level.

Table 24

A Scheffé Multiple Comparison of Mean Scores Obtained by 'Academic/Regulars', Academic/ Remedials', 'Technical/Remedials', and 'Externals' on the Technical Subtest.

Groups Mean Scores	Ac/Reg. 2.96	Ac/Rem. 3.77	Tech/Rem. 2.52	Ext. 2.50
Academic/Regulars	----	0.217	0.791	0.918
Academic/Remedials	0.217	----	0.271	0.032*
Technical/Remedials	0.791	0.271	----	1.000
Externals	0.918	0.032*	1.000	----

*Differences are significant beyond the 0.1 level.

Table 25

A Scheffé Multiple Comparison of Mean Scores Obtained by 'Academic/Regulars', Academic/Remedials', 'Technical/Remedials', and 'Externals' on the Timeliness Subtest

Groups Mean Scores	Ac/Reg. 3.87	Ac/Rem. 4.09	Tech/Rem. 3.89	Ext. 4.80
Academic/Regulars	----	0.847	0.999	0.046*
Academic/Remedials	0.847	----	0.201	0.904
Technical/Remedials	0.999	0.201	----	0.074*
Externals	0.046*	0.904	0.074*	----

*Differences are significant beyond the 0.1 level.

responses to Item 1, Part II and Item 19, Part IV yielded an averaged score of 4.0 or more. Those whose responses to these items averaged less than 3.0 were placed in the Low Advantage group. The remainder of the study population was placed in the Medium Advantage group. A summary of the results obtained from this subdivision is presented in Table 26. Significant differences in perceptions of efficiency, organizational constraints, pedagogical constraints, and generalizability were revealed.

In all cases except one, the High Advantage group scored significantly higher than both the Medium and Low Advantage groups (Tables 27 to 30). The exception is presented in Table 31--the High Advantage group scored significantly higher than the Medium Advantage group only.

Item analysis. The foregoing analysis was based on the use of subtest scores. Two important differences in perceptions were encountered in an item analysis.

Adopters of the network-based approach (on the average) did not perceive their students as being more productive than comparable students in other programs. On the other hand, observers perceived students in network-based programs to be more productive. The scores are presented in Table 32.

That the network-based approach served the self-interests of teachers was not apparent to all respondents. The Adopters perceived that self-interests were served to a significantly higher degree than did Observers. A comparison of scores is presented in Table 33.

Table 26

A Comparison of Perceptions of Feasibility Based on Perceptions of the Relative Advantage Derived from Use of the Network-Based Approach

Subtests	Low N = 12 $\bar{X}$	Med N = 21 $\bar{X}$	High N = 15 $\bar{X}$	Average N = 48 $\bar{X}$
Effectiveness	4.20	4.29	4.65	4.38
Efficiency*	3.94	3.93	4.36[a]	4.07
Organizational*	3.72	3.83	4.39[b]	4.00
Technical	3.27	2.89	3.39	3.16
Political*	4.18	4.21	4.77[c]	4.39
Pedagogical*	3.90	4.00	4.40[d]	4.11
Timeliness	3.76	4.05	4.32	4.06
Generalizability*	4.10	3.97	4.46[e]	4.16

*Differences are significant beyond the 0.05 level as determined by an F-test.

Low- average score for Items 1, Part II and Item 19, Part IV was less than 3.0.

Medium- average score for Items 1, Part II and Item 19, Part IV equal to, or greater than 3.0 and less than 4.0.

High- average score for Item 1, Part II and Item 19, Part IV was equal to, or greater than, 4.0.

[a]Differs from Low and Medium groups.

[b]Differs from Low and Medium groups.

[c]Differs from Low and Medium groups.

[d]Differs from Low and Medium groups.

[e]Differs from Medium group.

Table 27

A Scheffe Multiple Comparison of Mean Scores Obtained by 'Low Advantage', 'Medium Advantage', and 'High Advantage' Groups on the Efficiency Subtest

Groups Mean Scores	Low 3.94	Med 3.93	High 4.36
Low Advantage	----	0.999	0.054*
Medium Advantage	0.999	----	0.018*
High Advantage	0.054*	0.018	----

*Differences are significant beyond the 0.1 level.

Table 28

A Scheffe Multiple Comparison of Mean Scores Obtained by 'Low Advantage', 'Medium Advantage', and 'High Advantage' Groups on the Organizational Subtest

Groups Mean Scores	Low 3.72	Med 3.83	High 4.39
Low Advantage	----	0.786	0.001*
Medium Advantage	0.786	----	0.001*
High Advantage	0.001*	0.001*	----

*Differences are significant beyond the 0.1 level.

Table 29

A Scheffé Multiple Comparison of Mean Scores Obtained by 'Low Advantage', 'Medium Advantage', and 'High Advantage' Groups on the Political Subtest

Groups Mean Scores	Low 4.18	Med 4.21	High 4.77
Low Advantage	----	0.980	0.015*
Medium Advantage	0.980	----	0.006*
High Advantage	0.015*	0.006*	----

*Differences are significant beyond the 0.1 level.

Table 30

A Scheffé Multiple Comparison of Mean Scores Obtained by 'Low Advantage', 'Medium Advantage', and 'High Advantage' Groups on the Pedagogical Subtest

Groups Mean Scores	Low 3.90	Med 4.00	High 4.40
Low Advantage	----	0.784	0.014*
Medium Advantage	0.784	----	0.019*
High Advantage	0.014*	0.019*	----

*Differences are significant beyond the 0.1 level.

Table 31

A Scheffe Multiple Comparison of Mean Scores Obtained by 'Low Advantage', 'Medium Advantage', and 'High Advantage' Groups on the Generalizability Subtest

Groups Mean Scores	Low 4.10	Med 3.97	High 4.46
Low Advantage	----	0.807	0.221
Medium Advantage	0.807	----	0.021*
High Advantage	0.221	0.021*	----

*Differences are significant beyond the 0.1 level.

Table 32

A Comparison of Responses Made by 'Adopters' and 'Observers' to Item 1d, Part III: "Students in network-based programs are more productive than comparable students in other programs."

Groups	Mean Scores	N
Observers	3.97	16
Adopters	3.25	34
Total	3.48	50

The difference is significant beyond the 0.05 level as determined by a t-test.

Table 33

A Comparison of Responses Made by 'Adopters' and 'Observers' to Item 19, Part IV: "Use of the network-based approach to curriculum development and implementation provides distinct advantages for teachers."

Groups	Mean Scores	N
Observers	3.66	16
Adopters	4.16	34
Total	4.00	50

The difference is significant at the 0.05 level as determined by a t-test.

Several other significant differences were encountered. Observers scored significantly higher than Adopters on items pertaining to PPBS (Item 3, Part II) and use of resources (Items 2a and 2b, Part III). Adopters scored significantly higher than Observers on the item pertaining to the capability of the network-based approach for facilitating integration of various learning theories into curricular decisions (Item 42, Part IV).

Discussion

The data were analyzed in an attempt to identify variables which contributed to significant differences in responses from segments of the study population. It was believed that this information would be useful in drawing the study's final conclusions and recommendations. Being unable to rank the feasibility constraints in terms of importance it was felt that identification of polarizations in the perceptions of the study population could serve as an overall indicator of the quality of the remainder of the study data. Stated another way, feasibility is believed to be greater when there is agreement among the respondents and lessened when disagreement is evident. Tests for significant differences of opinion cannot assure that there is agreement but they serve to identify disagreements where these exist among the respondents.

A summary of the variables tested for contributions to significant differences of opinion is presented in Table 34. Because the variables yielding significant differences were identified through use of a multiple discriminant analysis,

Table 34

A Summary of Factors Resulting in Significant Differences in Perceptions of Feasibility

	Effectiveness	Efficiency	Organizational	Technical	Political	Pedagogical	Timeliness	Generalizability
Adopters, Observers (Table 8, Page 82)								
Teacher, Teach.-Admin., Admin., Others (Table 9, Page 83)								
Planning, Individualizing (Table 10, Page 84)								
Levels of Training (Table 11, Page 85)								
Levels of Network Experience (Table 12, Page 86)								
Levels of Teaching Experience (Table 13, Page 87)		*	*				*	
Teacher Preparation Programs (Table 17, Page 92)				*				
Work Setting (Table 18, Page 93)		*			*		*	
Preparation/Work Setting (Table 22, Page 98)		*		*			*	
Self-Interests (Table 26, Page 103)		*	*		*	*		*

*Differences are significant at, or beyond, the 0.05 level as determined by a t-test or an F-test.

and not on reviewed literature, discussion is limited.

Teaching experience. Experience was one of the factors identified as having the potential for causing differences in perceptions of feasibility. That experience is considered a major factor in establishing a person's worth is evident in most salary grids. The higher scores in this study of those with high levels of experience may be an indication that these people have more information at their disposal and consequently express less uncertainty than others with less experience.

Teacher preparation programs. A multiple discriminant analysis was used to cluster respondents on the basis of patterns in responses to the study questionnaire. One such cluster included most of those educators in the study population who had received post-secondary training in industrial arts or vocational education. When these Technicals were compared with other teachers (Academics) a significant difference in perception was revealed in relation to the technical subtest.

Work setting. Like the preceding case, work settings were identified as a variable through use of a multiple discriminant analysis. The study population was divided into those who work in regular classrooms or schools (Regulars), those in remedial classrooms or schools (Remedials), and those who are external to the school (Externals). The latter group included central office administrators, Department of Education personnel, and university professors.

The data analysis revealed that those in regular class-

rooms and schools scored significantly lower than others on the efficiency and political subtests. On the timeliness subtest the Externals scored significantly higher than others.

Combined effects. The two groups formed on the basis of teacher preparation programs (Technicals, Academics) were combined with the Regulars and Remedials to form a two dimensional matrix. One cell of the matrix was empty--the study population included no people with technical training in regular programs. Again, the Externals were retained as a group. Analysis revealed significant differences in responses to the efficiency, technical, and timeliness subtests.

In the case of the efficiency subtest the Academic/Regulars scored significantly lower than the Academic/Remedials and Externals.

The Academic/Remedials scored significantly higher than the Technical/Remedials on the technical subtest.

Paralleling the case discussed in the preceding section, scores of the Externals were significantly higher than Technical/Remedials on the timeliness subtest.

Relative advantage. Relative advantage is a concept noted by Rogers (1962:124-133) and Chin (1967:39-57). They contended that perceived relative advantage increases the likelihood that an innovation will be adopted. When the items used to assess relative advantage were used to subdivide the study population significant differences of perceptions were found with respect to the efficiency, organizational, political, pedagogical, and generalizability subtests.

Those who perceived the highest level of relative advantage in the network-based approach also scored significantly higher than all of the others on the efficiency, organizational, political, and pedagogical subtests. They scored significantly higher than the Medium Advantage group on the generalizability test.

On the one hand, the results tend to agree with the conclusions drawn by Rogers and Chin. On the other hand, the results may have been derived from weaknesses in the rating scale. Kerlinger (1964:516-517) noted four factors any one of which could account for the differences noted.

1. The halo effect describes the case where respondents rate items in one direction.

2. The error of leniency occurs when raters rate items too high.

3. The error of central tendency occurs when raters avoid extreme judgements.

4. The error of severity occurs when raters rate items too low.

Had the raters responded to any of these tendencies there would have been a high positive correlation between items pertaining to self-interest and all of the other items. The pattern would have yielded the significant differences encountered in this test. Had this been the case, however, one might have expected that there would have been significant differences in perceptions with respect to the other feasibility constraints as well.

Conclusions

On the basis of the findings it may be concluded that some differences in perceptions of feasibility of the network-based approach do exist in the study population.

On the basis of the detected significant differences it may be conjectured that work setting and relative advantage to the adopters are two key variables to be considered if further adoption of the network-based approach is planned. The nature of the work setting may be a key. For example: there may be factors associated with remedial schools that makes it easier to adopt innovations. There may also be factors that makes adoption imperative. Relative advantage may be another key variable. Adopters may judge an innovation in terms of its relative advantage or ability to serve their self-interests. Perhaps innovations are more acceptable if they suit the cognitive and teaching styles of the adopters.

PROCEDURE

The fourth research question asked: "Is the procedure offered for use by teachers engaged in developing and implementing network-based curricula useful in its present form?"

Findings

When asked how much information they received in preparation for network-based curriculum development, the responses were as follows:

Too little	11 responses
Almost enough	9 responses
Just right	3 responses

When asked how the procedure was used, the responses were as follows:

Used exactly as written	1 response
Followed with steps omitted	9 responses
Sequence of steps changed	4 responses
Used own procedure	3 responses
Trial and error	4 responses
Outside help	1 responses

Following is a tabulation of the problems most frequently encountered in network-based curriculum development:

Difficulty in sequencing objectives	14 responses
Not knowing when the network was finished	7 responses
Networks required revision	15 responses

Discussion

As the network-based approach progressed through stages of development, the procedure for applying it also changed. As a result, adopters of the innovation did not have, as the findings indicate, enough information about the approach nor a procedure that suited their unique application.

Conclusions

The findings support the conclusion that the procedure available to the Adopters was somewhat inadequate.

SUMMARY

The findings of the study have been presented, discussed, and conclusions drawn for each of the four research

questions. In general it can be said that:

1. The network-based approach was perceived by the study population to be more effective and efficient than other alternatives known to them.

2. The network-based approach was percieved to be more feasible for use in classrooms than other alternatives known to the study population.

3. Differences in perceptions of feasibility were found in the study population on the basis of: levels of teaching experience; types of teacher preparation programs; work settings; and, perceptions that self-interests were served by the network-based approach.

4. The procedure was not entirely appropriate to the needs and expectations of classroom teachers who were adopters of the network-based approach.

Chapter 6

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

SUMMARY

The network-based approach to curriculum development and implementation (based on PERT principles) was designed in 1970. After initial classroom trials, it was applied to a number of different curricula. As reported in this study, after a five year period, 34 teachers have adopted the approach in 14 different applications.

This study was undertaken to determine it the network-based approach to curriculum development and implementation can be used by classroom teachers to improve their classroom instruction.

Development of a conceptual framework for studying educational feasibility was the first step taken in this study. Educational feasibility was found to be constrained by effectiveness, efficiency, organizational factors, technology, politics, pedagogy, timeliness, and generalizability. Next, a research framework was designed and recent literature was reviewed to determine suitable assessment criteria for each feasibility constraint. These criteria were translated into a questionnaire which asked participants in network-based projects to compare this approach with other alternatives known to them. Responses to the questionnaire were collected and

analyzed. Findings were reported, discussed, and conclusions drawn in relation to each of the research questions.

CONCLUSIONS

Conclusions

The mean score for the combined effectiveness and efficiency subtests was 4.21. Combined, the mean score for the six feasibility subtests was 3.81. Finally, the mean score for all eight subtests combined was 3.89. Since all of the mean scores fall within the range of 3.5 to 5.0 established as an indication of feasibility (see Functions 22 and 25, pages 67-68) it may be concluded that the study population perceived that:

1. The network-based approach to curriculum development and implementation is an effective and efficient means of managing classroom instruction.

2. The network-based approach to curriculum development and implementation is feasible for use in classrooms.

Several significant differences of opinion were revealed by the data analysis. One resulted from work settings. Those involved in remedial classrooms and schools regarded the approach as more efficient than did those in regular classrooms.

The procedure offered for use by teachers developing network-based curricula was directed towards a particular form of instructional individualization. That may have contributed to the finding that the procedure was relatively ineffective. More curriculum development and implementation flexibility may have been needed.

Drawing together the study findings, it may be concluded that in the opinion of the study population the network-based approach to curriculum development and implementation can be used by classroom teachers to improve their classroom instruction. The utility of the approach may be greater to some groups of teachers than others. Further, special development and implementation procedures may be needed by each group in order to maximize utility.

Generalizations

The nature of this study does not justify generalizations on the basis of the conclusions. However, the study results do indicate that some educators find the network-based approach capable of improving the effectiveness and efficiency of instructional planning and implementation. For this reason the approach might be utilized more extensively. Because of its feasibility, as demonstrated in relation to the study population, further development may have a relatively high probability of success. As a step toward further increasing the probability of success more information and better curriculum development and implementation procedures could be provided for adopters.

Finally, the conceptual framework for studying educational feasibility should be generalizable to other educational studies. Moreover, the conceptual framework should be generalizable outside the field of education by replacing the pedagogical dimension with a dimension appropriate to the new field of study.

Weakness of the Study

Several factors, probably interactive, serve to weaken this study.

The feasibility model may be incomplete: there may be other equally important constraints which have not been examined. At the same time the identified constraints have been treated as equivalent, though future studies may prove them capable of being ordered.

The selection of assessment criteria defined as representative of each constraint was based, to some extent, on common sense. In most cases only guidelines and themes were discernible from the literature review. Another researcher may have chosen some other criteria for assessment.

Few controls were applicable to this study. Because of the limited number of people involved with the network-based approach, samples were not drawn from the population. Rather, the entire population was used in this study. In answering the first two research questions this was appropriate. In the case of the third research question (identification and interpretation of significant differences of opinion) the study may have been weakened. It must be remembered, however, that the purpose was not to test explicit hypotheses but to determine if some of the study findings may be functions of factors falling outside the research framework.

IMPLICATIONS

A feasibility study is carried out in order to justify recommendations for adoption or rejection of an innovation.

Because of the nature of feasibility studies two orders of implications are encountered. The first-order implications arise from the findings of the study itself. The second-order implications arise from the recommendations of the study. Both orders of implications are discussed in this section.

First-Order Implications

Feasibility studies are, as yet, quite uncommon in education. More frequently evaluations are undertaken. Because evaluations focus on achievements and accomplishments they are most often carried out as projects near completion. Feasibility studies examine innovations in their early stages and predict outcomes. Moreover, predictions are not solely based on attainment of objectives but rather on the basis of a wide range of issues. Feasibility studies are more global than evaluations.

As innovations emerge more feasibility studies could be carried out. This practice might more effectively screen out ineffective innovations and increase the proportion of adopted innovations that are of high quality.

The findings of this study suggest that the study population perceived the network-based approach as being highly technical. They were somewhat uncertain about the timeliness of the approach. Most of the adopters who expressed an opinion indicated that they received too little information during adoption of the approach. Many of the findings of this study imply that many of the teachers are functioning with information that is incomplete and/or obsolete. Steps could be taken to alleviate the situation by augmenting present

teacher-preparation programs with more of what might be considered to be educational technology. In-services could be provided for practicing teachers.

It may well be that the network-based approach lends itself to remedial programs where students need structured programs and more consideration of their individual differences.

Finally, it may be that not all innovations are equally feasible for all segments of the educational community.

Second-Order Implications

Educational technology. PERT has been integrated into curriculum development and implementation processes and found, by the observed population in this study, to be capable of improving the effectiveness and efficiency of classroom instruction. Other systems analysis techniques could also be analyzed for their potential contributions to an educational technology:

1. Linear programming could be examined to determine how effectively it might be used in solving production and student flow problems.

2. Queuing theory could be used to determine requirements for work stations and learning centres.

3. Work measurement and work simplification principles could be applied to a number of classroom practices in an attempt to increase educational efficiency.

4. Work space layout and landscaping could be used to make study areas more conducive to learning.

5. Reliability theory could be used to: predict equipment failures and hence replacement levels; predict how well teachers and students will fit into new roles; or, to identify bottlenecks and unreliabilities in the curriculum.

6. Human factors analysis could be examined to see if it can be used to improve the interface between students and their environment.

7. Value analysis could be applied to the study of high cost activities in an attempt to find better solutions.

8. Configuration management might be used to standardize a curriculum that is dynamic and free to change with changing needs.

In spite of the fact that none of these systems analysis techniques have been incorporated into an educational technology supportive of the network-based approach, the feasibility of the approach has implications for the educational system, teachers, students, administrators, parents, and teacher-preparation institutions.

The educational system. Bells that punctuate the school day into modules could be the first tradition to topple. Learning need not be limited to five hours per day for 200 days each year. Students, following their own networks, might be guided from learning situation to learning situation as their time and needs dictated.

Classrooms might be changed from their traditional design to work stations and resource centres readily accessible to students and carefully designed to integrate the student into

the learning situation. While equipment costs would likely drop, printed material costs might rise. More individualized media could be selected or prepared by teachers. Media materials might be expected to become even more concept-centred than an present.

Earning credits or advancing from grade to grade need no longer be constrained by time. Both could be based on achivement.

Teachers. By correctly utilizing equipment and media, teachers might be freed from part of the traditional teachers' role--dispensers of knowledge. Systematization of the administrative component of instruction may lead to freeing of additional teacher time. With the freed time teachers should be able to manage a larger number of students effectively. If students still required high amounts of attention, paraprofessionals could act as surrogate teachers.

The teachers' role could change from one of dispensing knowledge to one of facilitating learning and helping students test their generalizations. Much of the present evaluation bias could be removed.

Teachers could have a way of demonstrating accountability. In other words, the objectives to be achieved by the teachers and students and the ways and means of achieving them could be visible and understood by teachers, students, parents, and administrators.

Teachers could have an educational technology capable of serving their self-interests and at the same time

enabling them to effectively participate in PPBS model development and implementation. By failing to participate, other decision makers are forced to make decisions involving both teachers and programs. Yet, when PPBS models are fleshed out by inclusion of instructional objectives teachers might be able to make decisions leading to optimized productivity and efficiency.

Teachers might be able to incorporate contributions from a number of supporting specialists (curriculum specialists, psychologists, remedial experts) into the instructional program.

Students. Students could have opportunities to choose learning paths independently in keeping with their interests and to travel these paths at their own rate.

Students could be held more accountable. No longer would teachers have to bear the burden of students choosing not to achieve. At the same time, the approach has been perceived as capable of providing motivation for students--even those who require a great deal of motivation.

Students should be rewarded for accomplishments and not for residency as is the case with much of the present structure for advancement by grade or credit.

Parents. Parents should be able to perceive educational productivity more easily. Concurrently, parents should have clearer understandings of educational programs and would be able to make better choices for their children.

Administrators. Like teachers, administrators would have to learn to use educational technology. Also like teachers, they would be affected both by shifts in the bases of evaluation and enhanced capabilities for demonstrating accountability.

Administrators should be able to make better curricular decisions. Just as PPBS is able to aggregate the value of resource requirements, so the network-based curriculum can be aggregated. As courses aggregate into programs, high cost courses might be isolated for assessment.

Administrators may encounter fewer discipline problems. As an administrator (Vice-principal 2, Appendix C) observed:

> Our students have applied themselves more vigorously to the tasks at hand with the network approach than did they apply themselves with the conventional approach. Fewer discipline problems resulted.

With improved discipline, vandalism in schools might also be reduced.

Teacher-education institutions. Teacher training programs may have to provide more extensive instruction in educational technology and its practical application. It may be that future teachers should be taught, even more than at present, to be facilitators and managers of learning rather than dispensers of knowledge.

RECOMMENDATIONS FOR FURTHER STUDY

The study results suggest that the network-based approach to curriculum development and implementation can be used to improve classroom instruction. In the event that

more network-based projects emerge, controlled studies might be conducted to measure absolute differences in improvement between this approach and other more conventional approaches.

Other systems analysis techniques might be analyzed for their potential contributions to an educational technology. Among these systems analysis techniques are: networking (PERT, critical path method, precedence diagramming); flowcharting; operations research (linear programming, queuing theory, gaming, dynamic programming, simulation); methods improvement (work measurement, work simplification); work space layout and landscaping; and quality assurance (value analysis, human factors analysis, reliability, configuration management).

Studies might be carried out to determine the extent to which the network-based approach is "teacher free" (the extent to which equivalent outcomes are attainable by different teachers).

Studies might be carried out to determine the extent to which management of a network-based curricula can be enhanced by Electronic Data Processing.

Studies might be carried out to determine how the tasks of developing and implementing network-based curricula can be simplified.

Finally, both the feasibility framework developed for this study and the network-based approach might be tested in other settings to confirm their generalizability.

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APPENDIX A

PARTICIPANT IDENTIFICATION QUESTIONNAIRE

FACULTY OF EDUCATION
DEPARTMENT OF EDUCATIONAL ADMINISTRATION

THE UNIVERSITY OF ALBERTA
EDMONTON, CANADA
T6G 2E1

June 14, 1974

As a part of my doctoral program I am undertaking an evaluation of the network-based approach to curriculum development. The study will be based on the perceptions of those who have been involved in, or close to, applications of the approach.

To carry out this study I must first determine how extensively the network-based approach has been applied. You can help me in this respect by completing the enclosed questionnaire and returning it to me in the self-addressed envelope.

The study will be carried out at the beginning of the 1974-75 school year at which time a questionnaire will be distributed to those who have been associated with some aspect of network-based curriculum development or implementation. Since I have worked with many of you I know many problems have been encountered and a number of interesting variations and improvements developed. The study will summarize much of this information and should provide insights into areas requiring further development. The results of the study will be made available to anyone interested.

Thank you for cooperating with me in this initial step.

Respectfully,

Warren E. Hathaway

PART I IS TO BE COMPLETED BY ALL RESPONDENTS

(1a) Name: _____

(1b) Address: _____

(2a) Where do you work? _____

(2b) Address: _____ (2c) Telephone No.: _____

(3) Please indicate your present position with a checkmark.

Teacher ___ Administrator ___ Counselor ___ Librarian ___ Other: _____

(4) Please give the name and address of the person who provided your first contact with the network-based approach to curriculum development.

(5) Please give the names and addresses of persons who have adopted some aspects of a network-based approach to curriculum development because of your efforts. Use the back of this page if you need additional space.

(6) If you have held an in-service to discuss the network-based approach to curriculum development please indicate where, when, and for whom. Use the back of this page if you need additional space.

(7) Will you participate in this study? Yes ___ No ___

(8) Do you wish to receive a copy of the results of this study? Yes ___ No ___

PART II IS TO BE COMPLETED BY TEACHERS

(9a) Subject(s) taught: _____ (9b) Level of instruction: _____

(10) With a checkmark indicate the nature of your involvement with the network-based approach to curriculum development.

___ I developed my own network.

___ I worked as a member of a team in developing a network.

___ I use, or have used, a network prepared by someone else.

___ Some of my students have studied in network-based programs.

(11) With a checkmark indicate the use you make of your network.

___ I use it as a guide in planning my instruction.

___ I use it as the basis for organizing nongraded instruction.

___ I use it as the basis for organizing individualized instruction.

(12) Do you use networks as a means of reporting student progress? Yes ___ No ___

PART III IS TO BE COMPLETED BY ADMINISTRATORS, COUNSELORS, LIBRARIANS, AND OTHERS

(13) With a checkmark indicate the nature of your involvement with the network-based approach to curriculum development.

___ I implemented a curriculum development project using the network-based approach.

___ I observed the implementation of a network-based curriculum over an extended period of time.

___ I observed the implementation of a network-based curriculum during a classroom visitation.

APPENDIX B

STUDY QUESTIONNAIRE

A FEASIBILITY STUDY OF THE NETWORK-BASED APPROACH TO CURRICULUM DEVELOPMENT

This questionnaire is part of a study designed to assess the feasibility of using the network-based approach to curriculum development as a means of improving the effectiveness and efficiency of classroom instruction. Please answer the questions in this questionnaire on the basis of the experiences you have had with the network-based approach. If you feel that you cannot answer a question in parts II, III, or IV please place a check (✓) in the "Unable to Answer" column.

Thank you for completing this questionnaire and providing information about your experiences with the network-based approach to curriculum development and implementation.

Warren E. Hathaway
Department of Educational Administration
The University of Alberta

January 1975

PART I

Name: _____

School: _____ Phone: _____

Home Address: _____ Phone: _____

1. How many years of teaching experience do you have for which you are paid?

10.74 years

2. How many years of training do you have for which you are paid?

5.00 years

THE FOLLOWING QUESTIONS CONCERN THE NATURE OF YOUR INVOLVEMENT WITH THE NETWORK-BASED CURRICULUM DEVELOPMENT APPROACH.

3a. With a check (✓) indicate the nature of your involvement with the network-based approach to curriculum development (you may check more than one response).

16 a. I developed my own network.
10 b. I developed a network as part of a team.
8 c. I use, or have used, a network prepared by someone else.
16 d. I observed the implementation of a network-based curriculum development project.
0 e. Other (please specify) _____

b. If you checked a, b or c above, please indicate how you use your network.

15 a. I use it primarily as a guide in planning instruction.
19 b. I use it as the basis for organizing individualized instruction.
0 c. Other (please specify) _____

4. How many years of experience do you have with the network-based curriculum development approach?

2.78 years

PART II

HOW DOES THE NETWORK-BASED APPROACH TO CURRICULUM DEVELOPMENT AND IMPLEMENTATION COMPARE TO OTHER PRACTICES OF WHICH YOU ARE AWARE? PLACE A CHECK (✓) IN THE COLUMN THAT BEST EXPRESSES YOUR OPINION. USE THE FOLLOWING CODE.

CLEARLY INFERIOR	- clearly inferior to other available practices
SOMEWHAT INFERIOR	- somewhat inferior to other available practices
UNCERTAIN	- there are no clear differences when compared to other available practices
SOMEWHAT SUPERIOR	- somewhat superior to other available practices
CLEARLY SUPERIOR	- clearly superior to other available practices
UNABLE TO ANSWER	- I am unable to express an opinion

	The network-based approach to curriculum development and implementation:	CLEARLY INFERIOR	SOMEWHAT INFERIOR	UNCERTAIN	SOMEWHAT SUPERIOR	CLEARLY SUPERIOR	UNABLE TO ANSWER	Mean Score*
Org.	1. Serves the self-interests of teachers.	---	3	12	14	12	9	3.85
	2. Is compatible with long-range planning such as that set forth in the report of the Worth Commission.	---	---	6	17	17	11	4.30
Time.	3. Is compatible with constraints imposed by PPBES models.	---	---	12	9	6	23	3.77
	4. Is compatible with constraints imposed by Electronic Data Processing procedures.	---	---	12	7	8	23	3.85
	5. Is generalizable to many different subjects.	---	2	8	20	18	2	4.13
	6. Is generalizable to educational levels from K to 12.	---	---	12	17	16	5	4.09
	7. Is generalizable to school-wide applications.	---	1	8	24	13	4	4.07
	8. Is generalizable to school systems.	---	---	10	21	15	4	4.11
Gen.	9. Could be used in most school applications: public, private, correspondence, post-secondary.	---	1	7	20	19	4	4.20
	10. Could be used on a province-wide basis.	---	---	14	13	17	6	4.07
	11. May be used by any staff member, experienced or novice.	1	3	7	21	14	4	3.96
	12. Is acceptable to students.	---	---	6	21	19	5	4.31
	13. Is acceptable to teachers.	---	---	8	25	12	5	4.09
	14. Is acceptable to administrators.	---	---	13	16	15	6	4.05
	Total Responses	1	10	133	245	200	111	4.07

**"Unable to answer" responses excluded from calculation of means.*

15. If your response was "Clearly Inferior" or "Clearly Superior" for one or more of the items in Part II, please state below the factors that lead you to your conclusion.

All comments are included in Appendix C.

16. If your response was "Unable to Answer" for one or more of the items in Part II, please state below why you felt unable to express an opinion.

22 -No Comments

28 -Lack of information or experience

PART III

TO WHAT EXTENT DO YOU AGREE WITH THE FOLLOWING CLAIMS MADE FOR THE NETWORK-BASED APPROACH TO CURRICULUM DEVELOPMENT AND IMPLEMENTATION? PLACE A CHECK (✓) IN THE COLUMN THAT BEST EXPRESSES YOUR OPINION. USE THE FOLLOWING CODE.

STRONGLY DISAGREE - I strongly disagree with the statement

DISAGREE - I disagree with the statement

UNCERTAIN - I am uncertain about the statement

AGREE - I agree with the statement

STRONLY AGREE - I strongly agree with the statement

UNABLE TO ANSWER - I am unable to express an opinion

	STRONGLY DISAGREE.	DISAGREE	UNCERTAIN	AGREE	STRONGLY AGREE	UNABLE TO ANSWER	Mean Scores*
1. Students in network-based programs:							
a. Are able to see in the networks an overview of the course or program.	---	1	3	18	25	3	4.42
Ped. — b. Are able to see the curricular alternatives open to them.	---	1	5	19	19	6	4.27
c. Are able to relate their classroom activities to long-range curriculum objectives.	---	5	5	19	18	3	4.06
Effic. — d. Are more productive than comparable students in other programs.	---	2	18	9	11	10	3.73
Ped. — e. Exhibit positive self-images to a greater extent than comparable students in other programs.	---	---	19	12	9	10	3.75
2. Allowing students to be at different points in the curriculum leads to more efficient use of:							
a. Available laboratory equipment.	---	1	4	16	24	5	4.40
b. Audio-visual equipment.	---	---	4	17	25	4	4.46
Effic. — 3. Because the student record-keeping system is simple:							
a. The teacher has more time to spend with the students.	---	7	12	15	11	5	3.89
b. Better student records are maintained.	---	---	5	24	20	1	4.31
4. The quality of lessons and instructional material is evaluated on the basis of students' performance.	---	2	9	23	12	4	3.98

*"Unable to answer" responses excluded from calculation of means.

		STRONGLY DISAGREE	DISAGREE	UNCERTAIN	AGREE	STRONGLY AGREE	UNABLE TO ANSWER	Mean Scores*
Gen.	5. The approach is applicable to a variety of subject areas in special, elementary, secondary, and post-secondary education.	---	3	4	25	16	2	4.13
Org.	6. The network-based approach to curriculum development and implementation:							
	a. Can be applied by a teacher in a conventional classroom.	---	---	3	30	14	3	4.23
	b. Can be applied by a team of teachers and specialists.	---	---	2	30	16	2	4.29
Ped.	7. The network-based approach to curriculum development and implementation enables curriculum specialists to apply a number of theories of learning and child development simultaneously, though each theory may provide only a partial solution.	---	---	11	21	13	5	4.04
	Total Responses	0	22	104	278	233	63	4.13

*"Unable to answer" responses excluded from calculation of means.

8. If you have "Strongly Disagreed" or "Strongly Agreed" with one or more of the items in Part III, please state below the factors that lead you to your conclusion.

All comments are included in Appendix C.

9. If your response was "Unable to Answer" for one or more of the items in Part III, please state below why you felt unable to express an opinion.

33 -No comments

6 -Lack of information or experience

2 -Disagreed with the way items were expressed

1 -Felt constrained by variables outside the network-based approach

PART IV

HOW DOES THE NETWORK-BASED APPROACH TO CURRICULUM DEVELOPMENT AND IMPLEMENTATION COMPARE WITH OTHER PRACTICES OF WHICH YOU ARE AWARE? PLACE A CHECK (✓) IN THE COLUMN THAT BEST EXPRESSES YOUR OPINION. USE THE FOLLOWING CODE.

CLEARLY INFERIOR	- clearly inferior to other available practices
SOMEWHAT INFERIOR	- somewhat inferior to other available practices
UNCERTAIN	- there are no clear differences when compared to other available practices
SOMEWHAT SUPERIOR	- somewhat superior to other available practices
CLEARLY SUPERIOR	- clearly superior to other available practices
UNABLE TO ANSWER	- I am unable to express an opinion

Use of the network-based approach to curriculum development and implementation:		CLEARLY INFERIOR	SOMEWHAT INFERIOR	UNCERTAIN	SOMEWHAT SUPERIOR	CLEARLY SUPERIOR	UNABLE TO ANSWER	Mean Scores*
Effic.	1. Enables curricular programs to be developed by most teachers without extensive additional in-service training.	---	3	20	16	8	3	3.62
	2. Makes more efficient use of the time spent in planning and preparing instruction.	---	1	5	24	18	2	4.23
	3. Reduces the amount of time teachers spend in dispensing information to students and so increases the time available for evaluating and testing students's generalizations.	---	1	11	20	15	3	4.04
Ped.	4. Enables many different specialists such as psychologists and curriculum specialists to make contributions to the instructional program.	---	1	18	13	13	5	3.84
Effic.	5. Reduces the time spent in activities such as storing and retrieving student records, instructional materials, and resource materials.	1	3	18	12	14	2	3.73
	6. Reduces the time spent in maintaining student records.	1	4	16	17	10	2	3.65
Ped.	7. Provides clearer insights into those student behaviors which should be evaluated.	---	2	9	22	13	4	4.00
	8. Facilitates the evaluation of students on the basis of their performance.	---	---	3	20	24	3	4.45
Effic.	9. Pinpoints critical curriculum areas needy of revision on the basis of student performance.	---	---	2	20	26	2	4.50
	10. Facilitates evaluation of the instructional program.	---	---	3	25	19	3	4.34

*"Unable to answer" responses excluded from calculation of means.

Use of the network-based approach to curriculum development and implementation:		CLEARLY INFERIOR	SOMEWHAT INFERIOR	UNCERTAIN	SOMEWHAT SUPERIOR	CLEARLY SUPERIOR	UNABLE TO ANSWER	Mean Scores*
Effect.	11. Encourages the development of clear statements of goals and objectives.	---	---	2	17	28	3	4.55
	12. Clarifies the purpose of particular curriculum objectives.	---	---	2	20	24	4	4.48
	13. Increases the likelihood that the curriculum will be regarded as a whole rather than as discrete fragments.	---	3	5	19	20	3	4.19
	14. Identifies redundancies and overlaps in curriculum objectives.	---	1	3	23	19	4	4.30
	15. Identifies gaps in curriculum objectives.	---	---	4	23	21	2	4.35
Effic.	16. Makes more efficient use of personnel such as teachers, aides, and specialists in the instructional program.	---	---	19	15	13	3	4.08
	17. Makes more efficient use of resources such as equipment, materials, and supplies in the instructional program.	---	1	7	17	21	4	4.26
	18. Provides distinct advantages for students.	---	---	6	24	14	6	4.18
	19. Provides distinct advantages for teachers.	---	---	7	21	16	6	4.20
	20. Appropriately involves teachers in all stages of curriculum planning (identifying the problems, setting objectives, creating alternatives, selecting best alternatives, implementation, and evaluation).	---	1	10	20	15	4	4.08
Org.	21. Clarifies the rightful roles of students, teachers, aides, and specialists.	---	---	24	14	3	9	3.48
	22. Enables curriculum programs to be phased in gradually as development progresses.	---	1	7	23	13	6	4.09
	23. Allows flexibility in choosing how objectives are to be achieved.	---	1	8	23	14	4	4.07
	24. Necessitates reorganization of departments and/or the whole school.	2	3	19	5	6	15	3.29
	25. Enables teachers to apply their knowledge about their subject area.	---	---	14	20	12	4	3.95
	26. Enables teachers to apply their knowledge about technology.	---	---	17	15	12	6	4.11

*"Unable to answer" responses excluded from calculation of means.

Use of the network-based approach to curriculum development and implementation:	CLEARLY INFERIOR	SOMEWHAT INFERIOR	UNCERTAIN	SOMEWHAT SUPERIOR	CLEARLY SUPERIOR	UNABLE TO ANSWER	Mean Scores*
Tech. 27. Requires the use of processes and/or skills beyond the capabilities of teachers.	2	6	16	7	6	13	3.34
Tech. 28. Requires instructional equipment not readily available in most classrooms.	5	7	14	9	2	13	2.89
Tech. 29. Requires types of instructional equipment not available at any price.	2	3	13	6	6	20	3.37
Pol. 30. Allows each student to be treated as an individual.	---	---	3	21	23	3	4.43
Pol. 31. Enables students to: a. Choose independent programs.	---	1	6	17	21	5	4.29
Pol. b. Progress at their own rate.	---	---	1	17	22	3	4.60
Pol. 32. Enables students to become autonomous learners.	---	---	6	24	17	3	4.23
Ped. 33. Enables students to see both short- and long-range objectives.	---	---	6	18	18	7	4.28
Ped. 34. Facilitates evaluations which help students understand: a. Where they are going.	---	---	3	21	23	3	4.43
Ped. b. How well they are progressing.	---	---	2	18	25	4	4.50
Ped. 35. Allows the use of a combination of objectives--some based on intended performances and some based on intended experiences.	---	---	13	17	13	7	4.00
Ped. 36. Allows the use of: a. Cognitive objectives.	---	---	11	16	15	8	4.10
Ped. b. Psychomotor objectives.	---	---	12	17	12	9	4.00
Ped. c. Affective objectives.	---	1	17	13	10	9	3.78
Ped. 37. Allows the use of: a. Individualized objectives.	---	---	1	22	21	6	4.45
Ped. b. Group-centred objectives.	---	1	6	21	15	7	4.16
Ped. 38. Increases the likelihood that objectives to be attained by students match the students' needs.	---	1	6	23	15	5	4.16
Ped. 39. Increases student motivation.	---	---	13	14	17	6	4.09
Ped. 40. Allows subject specialists to make contributions to the curriculum.	---	---	8	18	19	5	4.24

*"Unable to answer" responses excluded from calculation of means.

Use of the network-based approach to curriculum development and implementation:

		CLEARLY INFERIOR	SOMEWHAT INFERIOR	UNCERTAIN	SOMEWHAT SUPERIOR	CLEARLY SUPERIOR	UNABLE TO ANSWER	Mean Scores*
Ped.	41. Allows any of the various theories of child development to be applied to curriculum decisions.	---	1	19	16	9	5	3.73
Ped.	42. Allows any of the various theories of learning to be applied to curriculum decisions.	---	1	17	18	9	5	3.77
Ped.	43. Is compatible with most bodies of knowledge (mathematics, science, reading, music, vocational subjects).	---	2	10	23	11	4	3.93
	44. Increases instructional flexibility.	---	3	7	19	16	5	4.06
Time.	45. Increases the likelihood of meeting the changing needs of students.	---	2	10	17	17	4	4.06
Time.	46. Enables programs to be revised and up-dated constantly without destroying the entire program and starting over.	---	---	3	19	23	5	4.44
	Total Responses	13	55	482	921	803	276	4.07

*"Unable to answer" responses excluded from calculation of means.

47. If your response was "Clearly Inferior" or "Clearly Superior" for one or more of the items in Part IV, please state below the factors that lead you to your conclusion.

All comments are included in Appendix C.

48. If your response was "Unable to Answer" for one or more of the items in Part IV, please state below why you felt unable to express an opinion.

33 -No comment

9 -Lack of information or experience

2 -Disagreed with the way items were expressed

3 -Restated position taken in responding to an item in order to avoid misinterpretation of the response

PART V

1. If your experience with network-based curriculum development and implementation has given you insights, *pro or con*, which have not been examined in this questionnaire please describe them below.

All comments are included in Appendix C.

PART VI

PLACE A CHECK(/) BESIDE THE RESPONSE THAT MOST ACCURATELY DESCRIBES THE EXPERIENCE YOU HAD IN DEVELOPING AND IMPLEMENTING A NETWORK-BASED CURRICULUM DEVELOPMENT PROJECT.

1. I feel that the amount of preparation I received in the use of the procedures for developing and implementing a network-based curriculum was:

   11 a. Too little.
   9 b. Almost enough.
   3 c. Just right.
   0 d. Somewhat too much.
   0 e. Excessive.

2. The procedures for developing and implementing a network-based curriculum were:

   1 a. Followed completely and exactly as stated.
   9 b. Followed with some of the steps omitted.
   4 c. Followed with some change in the sequence of the steps.
   2 d. Ignored in favor of my own procedures.
   5 e. Other (please specify). Trial & error (4), Outside help (1)

3. In using the network-based curriculum development approach I found (you may check more than one response):

   0 a. The procedure to be too technical to understand.
   14 b. I had difficulty in determining the correct sequence of curriculum objectives.
   7 c. I could never tell when my network was finished to a point where I could use it with confidence.
   16 d. I had to revise my network constantly.
   0 e. Other problems (please specify). _____

4. Check each of the areas in which you have developed curriculum networks.

   16 a. Language Arts
   1 b. Science
   0 c. Fine Arts
   0 d. Business Education
   18 e. Mathematics
   0 f. Physical Education
   0 g. Second Languages
   0 h. Social Sciences
   1 i. Home Economics
   6 j. Technical Education
   5 k. Industrial Arts
   1 l. Other (please specify) Options

5. Check each of the levels at which you have developed curriculum networks.

22 a. Elementary
2 b. Junior High
6 c. Senior High
5 d. Post-Secondary
13 e. Special Education
0 f. Other (please specify) _____

APPENDIX C

INSIGHTS AND COMMENTS OF THE STUDY PARTICIPANTS

APPENDIX C

INSIGHTS AND COMMENTS OF THE STUDY PARTICIPANTS

Participants were invited to declare the factors which they felt justified their extreme responses to items in Parts II, III, and IV of the study questionnaire. In addition, they were asked to include their insights, pro or con, into the network-based approach. All of these comments are documented below.

Teachers' Insights and Comments

Teacher 1. Goals and objectives are "built in" to the program. It is the case in this school that resources are used more efficiently.

My involvement has been somewhat peripheral, and as an observer, so I feel I cannot add any more except to say that my overall impression from teachers and students is very favorable.

Teacher 2. I think network-based curriculum development and implementation is "technically" excellent. It facilitates gathering of instructional material and using it in proper sequential order. Transition and progress in concept development is clearly defined. It minimizes duplication and minimizes presentation of instructional material without the prerequisite knowledge required by the student.

However, one disadvantage may be that having the program highly structured and individualized, many students lack classroom and group-oriented activities. Much learning, especially in the area of social skills, is learned incidentally in contact with peers. One danger is an attempt to make the program so individualized that you fail to meet all the needs of the student.

Teacher 3. Students need a great deal of direction in a positive way. The network gives the students an understanding of what is going on and where he stands in his educational development.

Teacher 4. Students attending a special education learning situation need a great deal of individualized instruction. It is also important for these students to see some direction in a positive way. The network system, in my opinion, offers a clear and personal directive in which both student and teacher may follow the academic achievements of the learner.

Teacher 5. [The network-based approach] provides specific goals, efficient record keeping and clearly defined areas.

After having worked on the network system I feel that these [Items in Part III] are positive aspects of it.

Teacher 6. I have used the network-based approach and find it helps in providing insight into finding weak spots students may be having. It provides an immediate goal for students to work toward. It outlines directions in which a teacher may proceed throughout the year.

Teacher 7. It forces a teacher to be always aware of objectives and thus less time is devoted to "other material". It provides more efficient use of time. The child is aware of progress.

A much more comprehensive list of skills enables a teacher to pinpoint and diagnose problem areas to a much more accurate degree. It can serve as an aid to grouping. There are fewer generalities and more specific information for parents.

As an on-going evaluative device the network seems highly motivating to students. They see their progress and are encouraged.

Sometimes a network approach may limit total experience in a subject as too much emphasis is placed on individual skills rather than a group of related skills. Out of the mastery of many independent skills overall performance need not necessarily improve.

Teacher 8. I found this system impossible in my teaching of Auto Repairs as I must follow a course of complete engine overhaul which must be done in a particular way.

I use a type of network but the variations are very limited. The student has really only one path to follow with only very simple choices.

Teacher 9. I find the networks to be flexible enough to change or modify. Every process can be broken down as in programmed learning. It is my opinion that a network is essentially a model for programmed instruction. There are certain "grey areas" or parts of learning which do not

lend themselves to network development. For example: in Social Studies one can have a bubble marked "Canada", another marked "England". These are separate entities, they can be taught, learned, and evaluated. Less concrete subject material like "values" are harder to teach, to learn, and to evaluate.

Use of a network and its record-keeping system has proven 3b [Item 3b, Part III] to me.

I have seen networks implemented in Elementary and Special Education.

Efficient, effective planning of a network and using a network myself have proven its advantages.

Teacher 10. The network-based approach lets both teachers and students know what level of progress has been achieved and where the student is to proceed for the next unit of instruction or lab work.

Teacher 11. The approach is time saving. There is equal assessment of all students. Personal biases of teachers are eliminated.

The teacher's time can be spent on individual students. Marking and evaluation is easier. Progress can be easily seen. Students progress at their own speed. The program can be easily administered by another teacher.

Unless the student is self-motivated, progress may be slow. Copying from others may take place. Evaluation is sometimes hard as one is not sure of the student's own efforts.

Teacher 12. I have been using the network-based approach in teaching Language Arts for three years and I would never go back to any other. However, I am using a network I myself planned. It is easy to follow and it works. The students are enthused and I know exactly where I am and where I am going. I feel it could be used in any subject and at any level.

The amount of work some students complete in a year using the network approach is fantastic. They are never bored, never run out of work. Almost everyday someone is excited about his latest achievement. The more able students are a constant source of information and inspiration to the students with lesser ability.

I find that many of the students go beyond what the teacher expects and beyond the objectives set forth.

Students with less ability (in a well-planned network) needn't feel defeated because there are so many things which they can do with a reasonable degree of success. This keeps them working and progressing.

It is not an exaggeration to say that many of my students do ten times the amount of work in Language Arts--in reading, research, creative writing, even thinking--that students of equal ability did before I used the network. Life in the classroom is much more interesting too.

I change my network to suit the needs of my class.

However, all of these advantages are based on the fact that I have over a period of three years worked out my own network and changed it when the need arose. Students have even asked that certain things be added (for example, a collection of saying, quotes, terse phrases, descriptive sentences, meaningful verse, etc.).

Teacher 13. The approach is useful in lesson planning. I use it to give parents a "bird's eye view" of the child's progress and achievement during interviews. However, our networks have been revised to the point where they are as much a profile sheet as anything, and I never did use them as technically or as strictly as intended. I feel uncomfortable with it in the reading area--many of the skills are constantly being broadened throughout the year, so how do you evaluate on your network. Networks lend themselves much more readily (in my opinion) to a subject like Math.

Clerical work increased to the point where a person could feel as though you might become the slave, and the network the master.

Guess it's like many things--theoretically it is ideal--putting it into practice is another thing.

Teacher 14. I found it difficult to answer some of the questions because my own experience has been solely with the Math curriculum. We have now gone to a revised type of system which allows at a glance to see the child's progress. With the network (bubble system) it was necessary to turn to another sheet to see which concept the child was on since the bubbles were only numbered [they didn't contain the name of an objective].

We now have the concept labelled with the marks appearing directly underneath. We have retained the color code for evaluation. In essence we have just converted from bubbles to columns--the complete network for each child on one page.

I use the sheets as both a guide to planning my lessons and as a means of keeping track of individuals at a glance. It is useful for parent-teacher interviews--parents are able to see at a glance where difficulties lie--whether it be one or two concepts or the whole program.

The assessment for each child is our own--for what we feel the child is capable of doing.

Teacher 15. I am limited in my thinking to a planning sense. If used in planning, I believe it will give any teacher the clearest insights into not only the ultimate objectives of any course but the various interconnected paths and steps in achieving those objectives. It does not matter how distant in time these ultimate objectives may be since all steps could serve as sub-objectives without disturbing the overall flow. It is also a relatively simple matter to translate such a step-and-path system into computer language.

"A picture is worth a thousand words" and assuming that the flowchart is explained to them, students are able to refer to it again and again to "see" where they are currently situated and the path before them. Regarding use of equipment, I am assuming that there is a large variety of activities and equipment for use in the course and if so, it speaks for itself that rather than having most of the class wanting one particular machine or piece of equipment at once, all equipment will be in use most of the time given a variety in the rates of student achievement.

Teacher 16. A uniform network system would make transferring from one school to another a much easier process. In two years of substitute teaching, I've found tremendous differences in schools as far as methods, content, and organization of programs, even in the same subject area.

The network system is excellent for the novice. I came with no experience or training in Language Arts. The network made it easy for me to set up individual programs for my students very quickly. Its easy to follow and provides objectives (short-and long-term) for both student and teacher.

The network has three major advantages for me.

1. The long-and short-term objectives are tangible. With the network I feel I know where I am going. A major problem is thus cleared up and I can spend time evaluating the means of getting where I'm going.
2. With six teachers using the Communication Skills network we pool our resources and have a common filing system and marking system. We share materials thus there

is no duplication of materials or programs. Teachers time is greatly reduced in programming material.

3. Students' needs come first. The network facilitates individual programming and the record-keeping system makes it easy to determine a student's progress.

School Administrators' Insights and Comments

Department head 1. The network graphically illustrates direction, time, constraints, and possible difficulties. It also points out where remedial work can be dove-tailed in for students.

Different teaching methods can be applied to different students in the same class at the same time.

Vice-principal 1. The system is built on long-range planning.

There are probably some courses that couldn't be taught by this method. I can think of none.

The wall-long graphic portrayal of the course from beginning to end with all the choices available to students shows students both long- and short-range objectives which they can relate to their classroom activities.

Students find and replace their own work.

The various bubbles, or steps, can be diminished or enlarged. Each step can be evaluated and altered if necessary without affecting the integrity of the course.

Because of the bubble system, omissions are readily noticed.

Students almost have individual programs therefore there is little crowding around the various pieces of equipment.

The student may choose one of several routes to an objective.

My only response [Part V] is that those I have spoken with regarding the system regret its coldness or rather, lack of warmth.

Vice-principal 2. Our students need individualized academic programs for remedial work--the network makes provision for the individualization of programs.

Our students have applied themselves more vigorously to the tasks at hand with the network approach than did they apply themselves with the conventional approach. Fewer discipline problems resulted.

One must provide opportunities for presentations of written and oral reports.

Vice-principal 3. The "overview" quality of the network-based approach has positive ramifications for both students and teachers. In my mind it is the most important characteristic of the approach.

Evaluation material geared to specific objectives makes it possible to assess individual student performance quite accurately. The use of network objective test material facilitates specific skill assessment. This in my mind is a positive factor of the network approach.

Networks require a clear statement of objectives--something we have been negligent in doing in the past.

In my experience, the network approach has been a strong positive motivating factor to the kids. They like to know where they are going and what is expected of them in the course of meeting the objectives of a particular program.

Vice-principal 4. Teachers are able to specialize in subject areas. I feel it can be used in Special Education as well as in regular classes.

General satisfaction has been expressed by staff and students.

Our students especially need individualized programs. They are able to see their progress more readily. The approach provides opportunity for developing responsibility.

Setting up programs has involved a tremendous amount of work--teachers have had to be prepared to spend many extra hours of work.

I have some concern about the number of teachers students receive instruction from although I also feel this problem may be overcome. Some of our students may be better served by having one teacher for academic subjects.

In preparing our students for "life" the greatest need for most of them is the development of social and emotional maturity--they are most likely to fail in this area. I am not sure how well the network serves them in this.

Principal 1. I have observed a continuing [illegible]rest and growth in the "professionalism" of staff me[illegible]s involved in this approach to curriculum organization.

— There is evident willingness to plan and work together in the interests of the students.

Student reaction both in performance and verbally expressed reaction is positive to this approach.

Teachers become more directly involved with individual students' needs and methods of trying to meet them.

The improvement of students' self-image...is one of the strongest assets of this method of school organization.

Principal 2. Long range programming is possible. Both teachers and students know where they are going--and the steps needed to get there.

The network-based approach can be generalized to a variety of settings. However, the users must understand the way to use it, so must the people it is used on (eg. students or teachers in a system) to obtain its full benefit.

Examination of the objectives by teachers, curriculum heads, and students is important and necessary. All should help develop the network. It is harder to implement if imposed by others--be it system, school, or province.

If networks are going to the "in" thing we need time at the local school level for participation in their development--not just initially, but continuously.

Insights and Comments of Others

Librarian 1. The students had a more enthusiastic approach to their assignments. They progressed at their own speed and ability so were not in competition with their classmates.

As a teacher-librarian I played a supportive role.... I found students more interested in learning more about their assignments to the extent that they began to look for additional sources. They became more independent in their research as they became more proficient in the use of the library tools.

Counselor 1. Long range planning and data collecting is made superior because of the preparation of curriculum

necessary to start the program. Statistics are much easier to obtain on short or immediately visualized goals.

Students with superior ability and students with problems (in the same class) become more visible--good?, bad?

Counselor 2. From my observations it would appear that the network-based approach is highly flexible and able to be generalized to different subjects, grade levels, and systems. Goals and objectives could be spelled out for each situation.

Students who were involved in the network-based approach to study had indicated to me that they experienced a great deal of satisfaction with the approach since they always understood what was required before proceeding ahead; they were competing with themselves only, and they were able to observe their own progress. Maximum use of lab equipment was possible since different students used it at different times.

Extensive time and energy are required to develop a network-based curriculum; but once established, it frees the teacher for a supervisory capacity in the classroom. Since students move at their own pace, it is readily obvious where their strengths and weaknesses are. It also becomes obvious which areas of the curriculum require revising.

My experience with this program was indirect, by counselling students who were involved with the network-based approach. It appeared that students in this program were more satisfied and performed at a more superior level than did these same students in other programs in the school which did not use the network-based approach.

Central office administrator 1. Planning is positive and objective; communications about objectives are clear between student and teacher; and, results are measurable if necessary.

I see the approach as being student oriented.

I consider the process to be basic to good teaching.

The matter of communications between teacher and students is an integral aspect of the approach. It helps to settle the objectives game played between students and teachers.

University professor 1. I see the merit of the network-based approach primarily as a management tool for planning

organizing, and controlling many aspects of the educational enterprise. It can also be used as a systematic way of identifying problems or bottlenecks in sequencing instruction.

The scheduling of educational technology (hardware) can be easily done using the network approach. Again, this system lends itself to management of all school subjects.

The time element is part of the network-based approach. This is not often the case when using other methods. The network allows you to identify various aspects of the curriculum graphically as parts of a whole.

Teacher evaluation and accountability are implied but not directly plugged into this instrument. I realize you are focusing upon curriculum but I see other factors of evaluation being considered. The training of personnel to use the network-based approach, I gather is to be done on an in-service basis.

University professor 2. It enables the user to anticipate delays in progress of projects and provides lead time for taking corrective action. This makes it desirable. Since it is also compatible with the items mentioned (PPBES, EDP, long-range planning)--this makes it clearly superior.

I've used it--I use it--and it works. Calcomp 141 should be used to make implementation, and more efficient use of the program, a more likely reality.

I have not used PERT in the context of evaluating performances but I see no reason why PERT can't do it provided the items fed into it are valid.

Your attempt to use PERT for student progress will probably work as an administrative task.

Your attempt to use PERT for evaluation of student progress may be a bit difficult--not for PERT--but for you.

University professor 3. A network-based program that I have used for a number of years has aided in organizing course content and my activities as a teacher to maximize my time as well as the students' learning time. The network also has been of assistance to me in my attempts to individualized instruction both in the design of learning packages and in the selection of audiovisual 'hardware'.

Most insights that I have developed apply to university students who have never been exposed to a network-based course. The result means that when these

students are informed that instruction will be individualized, they become apprehensive for the first few weeks of the course. After they see how the network is used for planning course content and organizing it the students fully accept it. The same comment could be made for evaluation. From the network the student knows exactly where and when evaluation will take place, particularly if a product chart is used in conjunction with the network.

APPENDIX D

THE MULTIPLE DISCRIMINANT ANALYSIS

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THE MULTIPLE DISCRIMINANT ANALYSIS

Related research, experience, and intuition are ways of identifying variables with a potential for significantly affecting the outcomes of a research design. Less frequently used for this purpose is the multiple discriminant analysis.

The multiple discriminant analysis (a special form of factor analysis) clusters respondents to a questionnaire on the basis of their response patterns. Examinations of these clusters of respondents may yield insights into new variables previously ignored in the research design.

Paraphrasing Kerlinger's (1964:650) description of a factor analysis, a multiple discriminant analysis is a method for determining k underlying variables (factors) shared by n respondents, k being less than n.

In a factor analysis each questionnaire item is correlated with every other item and factor loading coefficients are derived for each item in relation to a specified number of factors. Communalities (the common factor variance) for the items are the sums of the squares of the factor loadings.

When a multiple discriminant analysis is desired the computer is programmed to rotate the data field consisting of i rows of respondents and j columns of item responses to yield j rows and i columns. The data are then factor analyzed.

The data field for this multiple discriminant analysis

consisted of 79 items (rows) and 50 respondents (columns). Factor loadings for 8, 4, and 2 factors are presented in Figures 1, 2, and 3 respectively. Factor loadings which exceed 0.400 (Ferguson 1971:424) are treated as meaningful. Negative scores are ignored.

Tables 1, 2, and 3 contain the clusters formed on the basis of 8, 4, and 2 factors. Often, as was the case in this study, additional data are required in order to name the factor common to each cluster. Those planning to use a multiple discriminant analysis should attempt to collect as much demographic data as possible at the time the questionnaire is completed. In some cases factors must be named on the basis of intuition. In still other cases the factors cannot be named.

The multiple discriminant analysis, applicable to any data matrix, has a number of useful applications. It can be used:

- to confirm that controlled study groups did in fact share common factors.
- to identify uncontrolled variables that may have contaminated the study findings.
- instead of sociograms. Sociograms are limited to clusters of acquaintances and are based on perceptions of others. Multiple discriminant analysis yields similar results with groups where members are not acquainted. Because the multiple discriminant analysis is based on response patterns to question-

Figure 1

Factor Loadings for Eight Factors

	COMMUNALITIES	1	2	3	4	5	6	7	8
1	0.585	0.196	-0.138	0.644	0.097	0.032	-0.231	0.074	0.068
2	0.490	0.197	0.139	0.354	-0.092	0.528	0.147	-0.081	-0.008
3	0.690	0.400	-0.090	0.192	0.477	0.108	0.342	0.092	-0.144
4	0.615	0.265	0.264	0.225	0.542	-0.215	-0.078	-0.192	0.031
5	0.346	0.133	0.015	-0.026	0.427	0.160	-0.276	0.035	0.202
6	0.507	-0.383	0.122	0.373	0.093	-0.076	-0.106	0.317	0.059
7	0.699	0.266	0.220	-0.102	0.558	0.052	0.487	-0.042	0.145
8	0.716	0.479	0.004	0.159	0.331	0.493	0.096	-0.231	0.236
9	0.651	0.533	0.212	0.118	-0.057	0.297	0.286	0.234	0.282
10	0.420	0.047	0.379	-0.108	-0.006	0.205	0.563	-0.019	-0.059
11	0.599	0.137	0.532	0.072	0.422	0.204	0.237	-0.024	0.122
12	0.484	-0.102	0.667	-0.110	-0.014	0.666	-0.011	0.110	-0.027
13	0.638	0.199	-0.162	0.625	0.300	0.001	0.138	0.006	0.018
14	0.495	0.261	0.013	0.529	0.006	0.621	0.081	-0.086	0.003
15	0.686	0.684	0.146	-0.192	0.171	0.163	-0.257	0.031	-0.175
16	0.159	0.033	0.059	-0.043	0.024	-0.036	0.010	0.118	0.369
17	0.653	0.702	0.181	0.092	0.105	-0.148	0.218	-0.030	0.202
18	0.531	-0.062	0.218	0.375	0.114	0.425	0.257	0.166	0.231
19	0.723	0.152	0.091	0.049	0.697	0.137	0.508	0.167	0.125
20	0.629	0.252	0.091	0.176	0.095	0.178	-0.044	-0.055	0.694
21	0.267	0.238	0.331	0.051	0.154	0.041	0.268	0.019	-0.009
22	0.354	0.242	0.207	0.294	-0.052	0.214	0.158	0.219	0.211
23	0.697	0.191	0.301	0.092	0.020	0.196	0.128	-0.038	0.665
24	0.849	0.088	0.903	0.051	0.053	-0.025	0.079	0.045	0.105
25	0.639	0.059	0.673	0.096	0.169	0.353	-0.014	-0.110	0.068
26	0.909	0.121	0.928	0.052	0.101	0.010	0.050	0.073	0.111
27	0.867	0.230	0.330	0.123	0.348	0.320	0.055	0.192	-0.173
28	0.417	-0.047	-0.265	-0.109	0.066	-0.044	0.092	0.645	0.146
29	0.467	0.121	0.215	0.339	0.035	-0.038	-0.014	0.528	0.102
30	0.647	0.622	0.003	0.247	0.129	0.079	0.228	0.005	0.356
31	0.644	0.479	0.093	-0.026	0.261	0.481	-0.128	-0.244	0.191
32	0.435	-0.093	0.153	0.047	0.151	0.093	-0.077	0.579	-0.178
33	0.521	-0.002	0.247	0.653	-0.027	-0.016	0.177	-0.014	-0.032
34	0.570	0.695	0.206	0.140	0.045	-0.003	0.348	-0.050	-0.385
35	0.590	0.402	0.138	-0.089	-0.126	0.337	0.273	0.443	0.006
36	0.689	0.736	0.195	0.022	0.255	0.063	-0.155	0.026	0.124
37	0.662	0.214	-0.284	0.112	0.001	-0.272	0.163	0.634	0.146
38	0.521	0.446	0.195	-0.100	0.022	-0.019	-0.162	0.693	-0.030
39	0.484	0.010	0.020	0.264	0.137	-0.049	0.605	-0.062	0.150
40	0.496	0.168	0.226	0.193	0.450	0.353	0.019	0.115	0.197
41	0.571	0.329	0.405	0.341	0.095	0.207	0.233	-0.206	-0.182
42	0.890	0.027	0.323	0.889	-0.127	0.218	0.143	0.098	-0.304
43	0.519	0.619	0.268	0.042	0.200	0.050	0.025	0.134	0.051
44	0.868	0.148	0.896	0.049	0.139	0.041	0.122	0.098	0.111
45	0.668	0.066	0.212	0.615	0.103	0.030	0.298	0.014	0.354
46	0.559	0.639	-0.153	0.336	0.059	0.171	-0.007	0.048	0.142
47	0.129	-0.036	-0.034	0.067	-0.149	-0.208	-0.086	-0.040	0.228
48	0.429	-0.209	0.080	0.147	-0.061	-0.021	0.476	0.307	-0.158
49	0.881	0.069	0.205	0.086	0.629	-0.038	0.020	0.170	-0.146
50	0.572	-0.075	0.051	0.504	0.102	0.344	-0.151	0.395	-0.045
	27.863	5.354	4.937	3.465	3.177	3.073	2.769	2.665	2.423
PERCENT OF COMMON VARIANCE									
	100.000	19.215	17.718	12.437	11.403	11.028	9.938	9.566	8.697
PERCENT OF TOTAL VARIANCE									
	55.725	10.708	9.873	6.930	6.354	6.146	5.538	5.330	4.846

Figure 2

Factor Loadings for Four Factors

	COMMUNALITIES	1	2	3	4
1	0.290	0.237	-0.176	0.449	0.038
2	0.350	0.229	0.130	0.407	-0.339
3	0.452	0.581	0.017	0.317	0.117
4	0.239	0.361	0.302	0.130	-0.015
5	0.114	0.324	0.059	-0.021	-0.071
6	0.327	-0.228	0.155	0.409	0.289
7	0.356	0.457	0.342	0.171	-0.030
8	0.696	0.654	0.054	0.236	-0.446
9	0.471	0.594	0.228	0.251	-0.008
10	0.072	0.097	0.149	0.179	-0.089
11	0.533	0.303	0.605	0.240	-0.131
12	0.081	0.031	0.115	0.091	-0.241
13	0.492	0.327	-0.125	0.607	0.051
14	0.355	0.391	0.042	0.253	-0.300
15	0.544	0.651	0.163	-0.305	0.004
16	0.018	0.115	0.055	0.021	0.036
17	0.498	0.676	0.178	0.044	0.055
18	0.513	0.094	0.229	0.540	-0.400
19	0.389	0.411	0.239	0.387	0.113
20	0.304	0.423	0.061	0.215	-0.275
21	0.224	0.264	0.369	0.126	0.005
22	0.266	0.302	0.203	0.364	0.021
23	0.384	0.330	0.354	0.207	-0.327
24	0.801	0.078	0.890	0.053	-0.019
25	0.606	0.150	0.683	0.145	-0.311
26	0.871	0.131	0.922	0.056	-0.011
27	0.338	0.347	0.407	0.211	0.057
28	0.270	0.067	-0.202	0.089	0.469
29	0.375	0.176	0.221	0.340	0.423
30	0.566	0.697	0.007	0.273	-0.077
31	0.587	0.615	0.065	-0.018	-0.451
32	0.289	-0.000	0.218	0.134	0.473
33	0.393	-0.023	0.212	0.589	-0.017
34	0.208	0.367	0.236	0.119	0.058
35	0.285	0.446	0.181	0.142	0.183
36	0.643	0.769	0.203	-0.105	-0.008
37	0.592	0.250	-0.248	0.186	0.658
38	0.439	0.429	0.217	-0.158	0.427
39	0.246	0.089	0.066	0.482	-0.032
40	0.366	0.405	0.296	0.326	-0.091
41	0.414	0.299	0.409	0.316	-0.238
42	0.276	-0.038	0.311	0.422	-0.004
43	0.505	0.642	0.288	-0.000	0.097
44	0.837	0.172	0.897	0.055	-0.003
45	0.555	0.189	0.205	0.697	-0.076
46	0.535	0.667	-0.166	0.245	-0.047
47	0.016	-0.078	-0.091	-0.039	0.006
48	0.293	-0.203	0.136	0.382	0.296
49	0.230	0.232	0.309	0.154	0.238
50	0.303	0.055	0.070	0.520	0.150
	19.788	7.128	5.377	4.436	2.847
PERCENT OF COMMON VARIANCE					
	100.000	36.021	27.171	22.420	14.388
PERCENT OF TOTAL VARIANCE					
	39.575	14.255	10.753	8.873	5.694

Figure 3

Factor Loadings for Two Factors

	COMMUNALITIES	1	2
1	0.109	0.330	0.016
2	0.200	0.335	0.296
3	0.398	0.622	0.105
4	0.229	0.370	0.304
5	0.100	0.315	0.026
6	0.125	-0.166	0.312
7	0.346	0.471	0.352
8	0.544	0.724	0.141
9	0.467	0.626	0.273
10	0.062	0.136	0.209
11	0.515	0.336	0.634
12	0.028	0.067	0.155
13	0.215	0.448	0.122
14	0.229	0.457	0.143
15	0.316	0.561	-0.029
16	0.015	0.111	0.089
17	0.447	0.656	0.130
18	0.262	0.238	0.455
19	0.335	0.464	0.347
20	0.248	0.480	-0.135
21	0.212	0.272	0.372
22	0.232	0.363	0.317
23	0.309	0.382	0.404
24	0.674	-0.057	0.819
25	0.501	0.180	0.685
26	0.726	0.108	0.845
27	0.317	0.363	0.430
28	0.036	0.045	-0.185
29	0.134	0.198	0.307
30	0.558	0.742	0.081
31	0.401	0.632	0.037
32	0.051	-0.021	0.225
33	0.208	0.098	0.446
34	0.191	0.369	0.235
35	0.228	0.481	0.182
36	0.523	0.718	0.086
37	0.094	0.233	-0.200
38	0.119	0.338	0.073
39	0.105	0.190	0.262
40	0.360	0.461	0.384
41	0.381	0.365	0.498
42	0.216	0.043	0.463
43	0.410	0.605	0.210
44	0.692	0.148	0.819
45	0.330	0.330	0.470
46	0.513	0.711	-0.087
47	0.015	-0.082	-0.093
48	0.101	-0.146	0.282
49	0.150	0.227	0.314
50	0.096	0.148	0.272
	14.075	7.849	6.227
PERCENT OF COMMON VARIANCE			
	100.000	55.759	44.241
PERCENT OF TOTAL VARIANCE			
	28.150	15.696	12.454

Table 1

Analysis of Eight Factors

Factor Number	Respondents	Factor Name	Basis for Naming Factor
1	3, 8, 9, 17, 30, 31, 34, 35, 36, 38, 43, 46	Technical	Demographic data
2	11, 24, 25, 26, 41, 44	Unknown	
3	1, 13, 33, 45, 50	Affinity group	Teachers selected by respondent 13 (a principal)*
4	3, 4, 5, 7, 13, 40, 49	Unknown	
5	2, 8, 12, 14, 18, 31	Unknown	
6	7, 10, 19, 39, 48	Special Education	Involved in some form of remediation*
7	28, 29, 32, 35, 37, 38	Unknown	
8	20, 23	Unknown	

*Naming of this factor required the collection of additional data beyond that collected by the study questionnaire.

Table 2

Analysis of Four Factors

Factor Number	Respondents	Factor Name	Basis for Naming Factor
1	3, 7, 8, 9, 15, 17, 19, 20, 30, 31, 35, 36, 38, 40, 43, 46	Technical	Demographic data
2	11, 24, 25, 26, 27, 41, 44	Unknown	
3	1, 2, 6, 13, 18, 33, 39, 42, 45, 50	Elementary education	Demographic data
4	28, 29, 32, 37	Unknown	

Table 3

Analysis of Two Factors

Factor Number	Respondents	Factor Name	Basis for Naming Factor
1	3, 7, 8, 9, 13, 14, 15, 17, 19, 20, 30, 31, 35, 36, 40, 43, 46	Administrative	Demographic data
2	11, 18, 23, 24, 25, 26, 27, 33, 41, 42, 44, 45	Elementary education	Demographic data

naire items, and not on one's perceptions of others, some bias may be removed from sociometric studies.

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